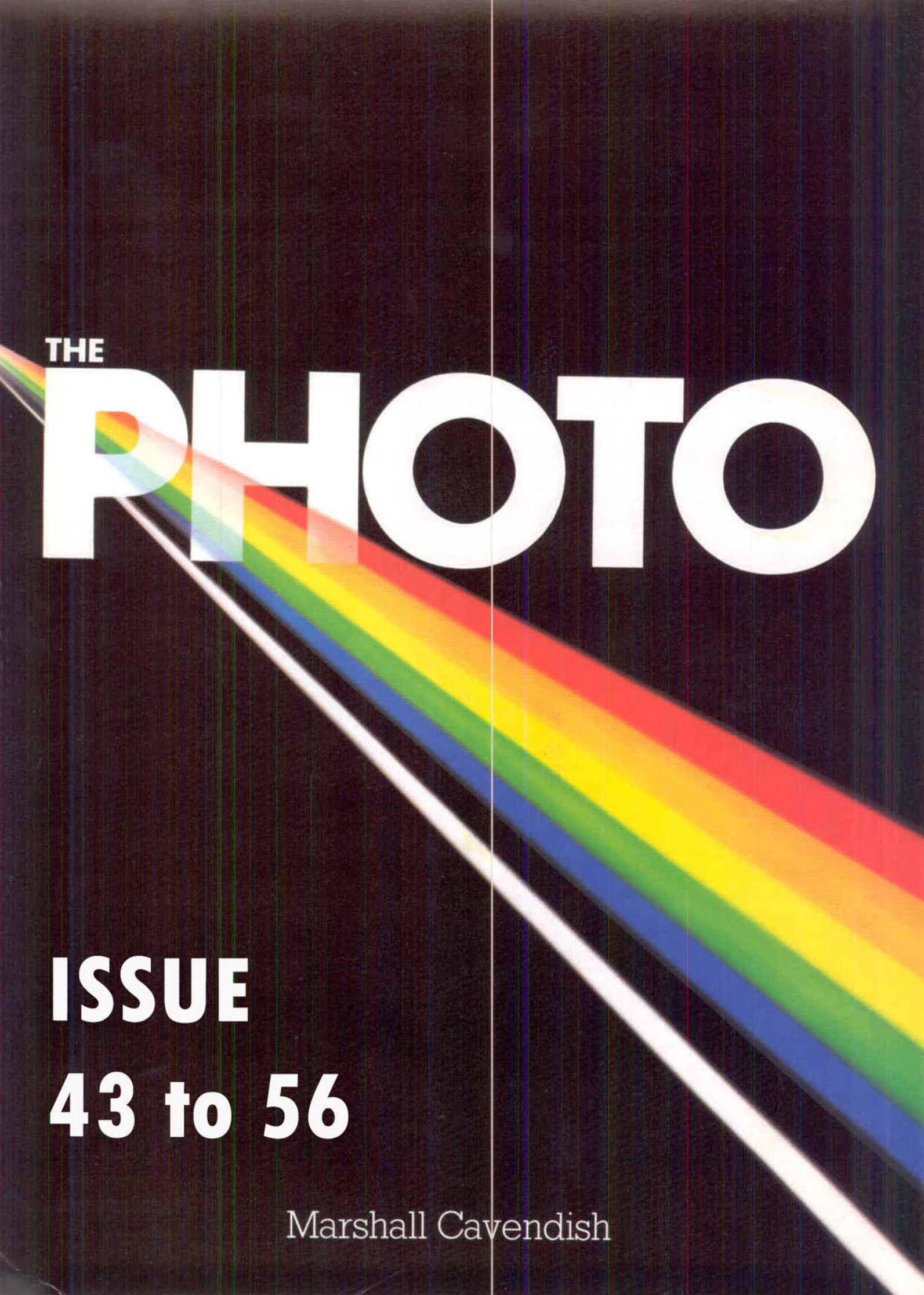

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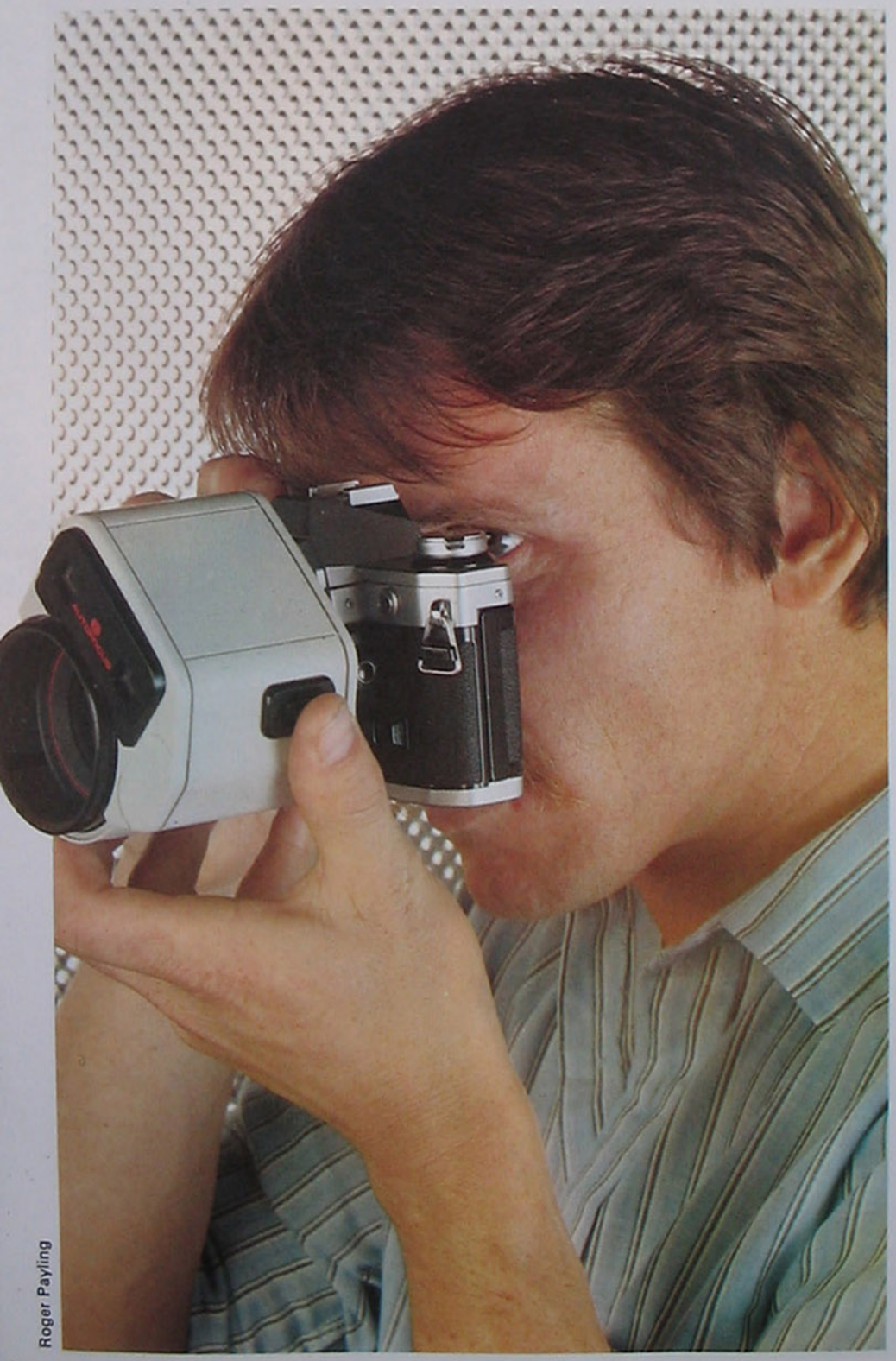
Marshall Cavendish

Autofocus cameras

Autofocus cameras and lenses are ideal for candid and documentary photography and for action shots. Their convenience has made them increasingly popular with 'serious' amateurs and professionals alike



Roger Payling

Pressing the shutter at just the right time often means the difference between success and failure. Yet it is all too easy to miss the 'decisive moment' just because you are concentrating on getting the subject in focus. One increasingly popular solution to the problem is autofocus, either in the form of a genuine 'point and shoot' camera with automatic exposure and focusing, or a specially made self-focusing SLR lens that fits on a normal SLR.

Autofocus cameras and lenses are ideal for taking quick, candid shots, where speed is of the essence—many professional candid photographers and photojournalists are now beginning to use them as a back-up to a normal SLR. They are also useful in situations where you are unable to focus manually, such as when holding the camera above a crowd, or for remote control shots.

Autofocus systems may be fooled in a number of circumstances (see table on page 1176) and may fail to give sharp pictures with some types of subject. Because autofocus takes a fraction of a second to operate, all the cameras actually fire the shutter after you press the release button and not at the precise moment of pressure. Rapid, sudden action shots can therefore be completely mistimed.

Flash shots are also complicated by the fact that a wrong distance setting on an autofocus camera will also throw the exposure setting out. The aperture automatically selected depends on the film speed set and on the distance. Nevertheless providing you avoid the obvious pitfalls, autofocus cameras and lenses can guarantee that most pictures taken in good light are perfectly sharp. For people with poor eyesight or for those unfamiliar with focusing techniques they can be invaluable.

Autofocus cameras

Cameras with an autofocus facility are largely intended for the amateur 'snapshots' and are generally not as versatile as an SLR although some offer a host of

Autofocus lens *The Canon FD 35-70 mm zoom lens is a bulky but convenient way of turning your 35 mm SLR into an autofocus camera. The zoom feature is manually operated*

sophisticated facilities designed to make life easier for the photographer. The Canon, for instance, offers auto film load, motor wind and rewind, and a camera shake warning sign. The Yashica-2 has an LED display to indicate the focusing distance and another warning light that illuminates when flash is necessary.

There are a number of different types of system used to focus the cameras. The *passive* system—often called the Visitronic system after the original model developed by Honeywell—uses two rangefinder windows to match an image of the subject and project it on to light sensitive cells (see pages 642 to 643). The *active* system works by sending out a signal of infrared light or sound which bounces off the subject and returns to the camera. There is also a prototype system now being developed which uses two photoelectric cells to measure the intensity of the image coming through the lens.

All of them are operated in a similar way. To focus an autofocus camera, you press the shutter release—on the SLR lenses, you press a special focus button. The autofocus mechanism focuses the lens using a spring or electric motor to wind it out to the correct position.

With the older, spring driven mechanisms, you cannot refocus the lens until you have taken a picture. With electric motors you may be able to refocus simply by releasing the shutter and depressing it again. This facility is known as repeatable prefocus.

Most autofocus lenses have repeatable prefocus, but many autofocus cameras, particularly those using the passive system, do not. It is worth paying a little extra to ensure you have this facility—it

Roger Payling

Ricoh 50 mm f/2 *This was an early autofocus lens to appear on the market and has the versatile K fitting*

can be very annoying to have to waste a shot if the subject moves before you press the shutter fully or if you decide not to take the picture.

It is also worth making sure that the camera has a focus lock. This is important because nearly all autofocus cameras focus on a small spot in the centre of the frame. They therefore focus incorrectly if the subject is not in the centre of the frame. If, in a shot of a couple of people, the gap between them is in the centre of the frame, the camera will focus not on the people but on the background. With a focus lock, you can aim the camera so that one of the people is at the centre of the frame, set the focus and then hold it while you swing the camera round to achieve the desired composition. All but the most basic cameras now have this facility.

Autofocus cameras also focus incorrectly if the subject is too close to the camera. With a subject nearer than the

Jack Burnicle

Autofocus cameras *can be fooled by railings or cage bars, tending to focus on them rather than the subject behind*

camera's minimum focusing distance, the mechanism usually focuses on infinity. Minimum focusing distance varies slightly from camera to camera—some only focus down to 120 cm, while others go down to 90 cm and if you intend to do a considerable amount of close work, it may be worth searching for a camera that will focus at shorter distances—the extra 30 cm may make all the difference.

Unfortunately, the lens on an autofocus camera is usually fixed—only a few of the more advanced cameras allow lenses to be changed. Like 35 mm compact cameras, the lens is normally in the order of 38 mm in focal length, giving a fairly wide angle of view and good depth of field even at maximum aperture. Few of the lenses are very fast—they usually have a maximum aperture of *f*/2.8—since the cameras are not intended for use in extreme conditions—only the sophisticated Canon AF35ML with its *f*/1.9 40 mm lens has any pretensions to speed.

Again, the range of shutter speeds available is rarely very wide. The Konica C35AF, for example, which was the first autofocus camera to be marketed internationally, has only a very simple

Jack Burnicle

Roger Payling

Wrong again *Autofocus cameras without a focus lock focus on the background through a centre of frame gap between subjects. Cameras with a focus lock like the Yashica, left, allow you to focus and then recompose*

exposure system with a maximum shutter speed of 1/250 second—this is not fast enough to freeze rapid action. Some of the more expensive cameras have a maximum speed of 1/500 second, but none have anything faster.

Choice of autofocus camera eventually boils down to the focusing system most appropriate to the type of conditions in which you are likely to use the camera—some photographers benefit more from a camera using the active system, others prefer the passive system. Neither system has been proved more or less accurate in focusing. The difference comes in their limitations.

Most passive systems need plenty of light to function properly and in low light, they will fail altogether. In situations where flash would be necessary, a passive autofocus camera cannot be used. These are often the situations where autofocus is most valuable—for candid shots or amusing pictures of parties. Several cameras that use the passive system have a low light warning which indicates when it is too dark for them to operate. A few passive autofocus cameras have their own light source which directs a beam of light at the subject and allows the focusing mechanism to work in complete darkness, but this type is much more expensive.

The active system, on the other hand, has no problem operating in low light and functions equally successfully in brilliant daylight or pitch darkness. Ultrasound, however, can be fooled by

Alan Stewart

Too close *Most autofocus cameras have a limited focusing range, usually between 90 and 120 cm. Shooting too close to a subject will yield unsatisfactory, blurred results (below) as the camera automatically focuses on infinity. The Canon autofocus zoom lens focuses automatically to 100 cm but this can be overridden by a manual setting down to 50 cm. The only way that you can obtain close-ups with your autofocus is to shoot within the permitted focusing distance and then enlarge the image later, if you have prints made*

glass which reflects the sound while infrared systems can be fooled by highly reflective, polished surfaces.

If you already own an SLR, and feel that an autofocus camera does not give you quite the flexibility you want, you may prefer to spend a little more and buy an autofocus lens.

Autofocus lenses

The autofocusing lenses produced by Ricoh and Canon have added another dimension of versatility to the 35 mm SLR. Although they cost about twice the price of a normal lens, they are completely self-focusing, using a separate optical-electronic rangefinder in a bulky housing around the lens which also contains the batteries and a motor to drive the lens.

It is, perhaps, inevitable that one of the first such lenses to be produced has the 'standard' focal length of 50 mm. It is a Ricoh lens with a maximum aperture of *f*/2 which uses the Honeywell Visitronic system. The lens is wound out continuously to focus on the subject, so it is possible to follow moving objects smoothly.

The Canon 35–70 mm *f*/4 zoom AF, on the other hand, does not focus continuously but moves instead to one of eight zones—1, 1.2, 1.5, 2, 3, 5, 10 metres, or infinity. Depth of field covers any slight focus discrepancies which may result. For more accurate focusing, this can be overridden by manual setting down to 50 cm. The focal length is set manually, but the autofocus works at all zoom settings.

The lens uses the same type of focusing system as Canon's AF35ML autofocus camera. To activate the system, a button on the lens is pressed, and when focusing is completed, a bleep is emitted. No indication is given of the distance set, the only check being the view through the SLR finder.

Their bulk can make autofocus lenses rather unwieldy, but many professionals, particularly sports and action photographers, are adding the Canon lens to their range of equipment. For amateur use, the Ricoh has the advantage of a Pentax K-mount which means that it can be attached to any one of the large number of SLRs now using this fitting.

Pentax produce a very sophisticated autofocus system based on an SLR. This is the ME F, featuring an autofocus sensor which uses a secondary mirror attached to the main reflex mirror. This gives through the lens focus sensing, and with the special servo driven Pentax lenses gives full autofocus capability. The camera also accepts normal lenses giving out a bleep and lighting an LED when correct (manual) focusing is achieved. This development means that autofocus cameras can now achieve a similar versatility to standard SLRs.

Problem subjects:

Those without strong vertical lines—waves at sea or window blinds
Those with little or no contrast
Those with bars or railings between themselves and the camera (Visitronic system cameras)
Those with window glass between subject and camera (infrared systems)
Those with strong reflections or those strongly backlit
Two subjects with a gap in between them (cameras without prefocusing)

Roger Payling

Rollerskaters *and other action subjects are ideally suited to autofocus cameras which can focus quickly and efficiently on centrally located subjects like this one—even if they are moving rapidly towards the camera*

Built-in flash *Most autofocus cameras include built-in flash. This is often a pop-up unit activated by pressing a switch in the rear of the camera. Some autofocus cameras have a warning light to indicate when the flash must be used*

Jack Burnicle/skates courtesy of Back-to-Front

Autofocus features

Most autofocus cameras are fitted with a 38 mm lens, and have built in flash and a minimum focusing distance of between 90 and 100 cm. But there are a few which offer a range of useful additional features

Camera	AF system	Special features
Cosina 35 AF	Visitronic	Manual focusing option, self timer
Fujinon Flash AF	Visitronic	Built-in light beam for low light photography, shutter lock
Minolta Hi-Matic AF2	Infrared	Repeatable prefocusing, self timer
Yashica Autofocus	Visitronic	LED focus set signal, prefocusing facility, low light warning signal
Ricoh AF-2	Visitronic	Built-in light beam, repeatable prefocusing, motorized film load, advance and rewind
Canon AF35ML	Infrared	Auto film load, motor wind and rewind, repeatable prefocusing, camera shake warning signal, self timer

Assignment

Bavarian castle

The character of a historic place is not easy to pin down with a camera and, as Sergio Dorantes shows, there is more than one way to approach it

All too often a photograph of a castle or another historic building turns out to be a disappointment. The building loses its charm and mystery when photographed in the cold light of day and made to appear the way it normally does to the eye. To try and retain the atmosphere of the place calls for a more thoughtful and original approach. So for this assignment we chose the fairytale castle at Neuschwanstein in Western Germany and sent Sergio Dorantes there to see how he would tackle the subject.

Sergio rarely photographs anything in the most obvious way and, instead, always looks for ideas which will give his work individuality and draw the attention of the viewer who looks at the final images. So for this assignment, Sergio started work with the dawn light and spent a good part of the day walking around the surrounding countryside looking for the best vantage points and

Blades of grass *Lying on the ground Sergio used a 17 mm lens at f/11 to fill most of the frame with the grass while also including the distant castle through a gap in the foliage.*
Commanding position *(below opposite) This is a more conventional approach but it has been carried out with careful attention to detail. The darker foreground area gives the castle prominence. 28 mm lens, f/11 at 1/60 sec.* **Two girls** *A distracting element has been added to this closer view of the building but it gives human interest as well as an extra pictorial element.* **Blue mist** *The haze invests the scene with mystery in this 300 mm shot. To make it more attractive, Sergio included the green trees which give the scene depth and warmth.* **Long shot** *The 300 mm lens has been used to pick out part of the building while also contrasting it with the rural surroundings*

Blue mist *By taking this photograph standing well back from the building and using a telephoto lens, Sergio has avoided the distortion of closer, wide angle views*

Photographs by Sergio Dorantes

angles and for gaps in the foliage.

The selection of photographs shown here illustrates the effects of different vantage points and the use of different lenses. It is noticeable that only one of the photographs was taken at close range and even in this one, half of the composition is taken up by the two girls in the foreground. This is partly because the wide angle shot would have made the characteristic foreshortening of the building more obvious without the foreground details. But more than this, without the two girls there the image would have lacked depth, colour and general interest.

As usual, Sergio carried his full range of Nikon cameras and lenses as well as plenty of Kodachrome film and a tripod. All this equipment makes the going rough when you have to trudge around the countryside looking for the best locations.

Colour Posterization

Any picture you have taken—whether in b & w or colour—can be transformed into a colourful semi-abstract by combining lith film posterization methods and colour printing techniques

Tim Stephens

Original transparency *Just about any photograph can be posterized but a simple image is usually more effective*

Basic negative *A b & w negative must be made by enlarging the original transparency on to suitable film*

Colour permutation *Colour posterization can give many different results. This is a positive print on Cibachrome (above right)*

Colour posterization is a technique you can use to produce strikingly effective pictures. A black and white posterization (see pages 925 to 927) produces a picture made up of black, white, and a few intermediate shades of grey. In colour posterization, the tones of the original picture are translated into different colours that can be as brilliant as you choose. Thus, deep shadows might be reproduced as yellow and the highlights as blue, or vice versa. The choice of colours is entirely under your control.

What you need

To make colour posterizations, you must know how to make ordinary colour prints and black and white posterizations. If you have already mastered these techniques, progressing to colour posterization is not hard. You need to have the usual equipment for making colour prints. Ideally, you should use an enlarger with dial-in colour filtration. Gelatin colour printing filters can also be used, but your enlarger filter drawer must slide in and out smoothly, since minor vibrations can create registration problems when you are making enlarged separations. A home made pin register board, as described on page 927, is also a great help. You also need lith film and developing materials as used for making black and white tone separations.

Either negative–positive or reversal colour print materials are suitable for colour posterization. Reversal materials are slightly easier to work with, since they make it simpler to follow the effects of filter changes.

Whatever type of print material you choose, you should have a full set of both positive and negative lith separations of each image you wish to print if you are to take full advantage of the range of variations allowed by colour posterization. If you want your final result to be as bright as possible, you should have a set of three tricolour red, green and blue filters, preferably gelatins that can be held under the enlarger lens to give the least vibration.

How it works

Most methods of producing colour posterizations involve printing various combinations of lith negatives or positives in register on a sheet of colour paper. The sheets of lith film may be sandwiched or printed in register, depending on the effect you want. Basic procedures for using lith materials are dealt with on pages 914 to 917, while those for registering sheets of film are described on page 927.

When a black and white posterization is made, each sheet of lith film is printed on black and white paper in such a way that it produces a particular shade of grey. In colour posterization, you print each lith sheet in a particular colour, according to your choice. Each sheet of lith film acts as a mask. If you print each sheet of film in succession and change the colour of the printing light for each exposure, you colour in a different area of the print each time.

Preparing the separations

The individual tone separations for colour posterization are prepared in just the same way as those for black and white work (see page 926). If you wish, you can use the same separations for colour as for black and white. But while a black and white tone separation results in a picture with the same general appearance as the original, though with more limited tones, colour posterization can make a subject look totally different —often surreal. You should take this into account when making the separations.

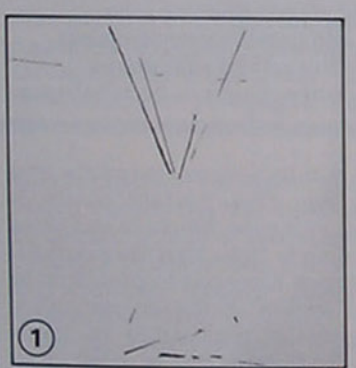
A picture of a face, for example, may have its original tonal rendering when posterized in black and white, with dark eyes, grey shadows, and bright highlights. In colour, however, it would be possible to produce a face with green eyes, red shadows and yellow highlights, or any combination you please. When you make the separations, therefore, it would be a good idea to plan the result and choose the areas for each colour accordingly.

Having made your positive separations, contact print these to make lith negatives

Negative and positive separations

Tone separations *These are tone separations produced by contact printing enlarged basic negatives to yield positives corresponding to the highlights (1) mid tones (2) shadows (3). An overexposed tone separation (4) and an underexposed, overdeveloped tone separation (5) may be found useful in addition to the standard group of tone separations*

Drop out masks *These are for masking off large areas of detail. They can be made by pinning a sheet of acetate over an existing enlarged negative, and using photo opaque to paint out the areas not required (1). A negative mask (2) and then a positive mask (not shown) can be made simply by successive contact printing on lith film, using a suitable jig*



Fine detail masks *A second type of drop out mask can be made to exclude (or colour) fine detail. To make large area drop out masks, pin acetate on to a final size image (one of the separations, for example), and use suitable opaque material to mark the acetate where required. By successive contact printing, make negative (1) and positive (2) lith masks*

Combination drop out mask *By binding together the positives of individual drop out masks and contact printing them, you produce a combined negative drop out mask.*

The colour posterizations shown overleaf were made from the tone and colour separations shown here. Although it is possible to make your prints on normal neg-pos colour printing paper, a direct positive material such as Cibachrome is preferable as it makes it easier to work out the effects of using a particular combination of separations. Additive colour printing methods using separate exposures to blue, green and red light enable the separations to be changed after each colour has been printed

Colour separations *These are produced at the same time as the basic negative if only to ensure that the enlargement remains the same. Project the original transparency on to suitable film, printing through a red filter for one negative image (1). Then make negatives through blue (2) and green filters (3). Contact print these to produce positive colour and tone separations (4)*

Colour permutations

Blue exposure through the shadow tone separation positive + green exposure through highlight tone separation positive + red exposure through mid tone positive

Green exposure through dense positive tone and colour separation + red exposure through overexposed tone separation. No blue exposure

Green exposure through dense positive tone and colour separation + red exposure through the green colour separation negative. No blue exposure

Green exposure through drop out negative mask + red exposure through underexposed tone separation with drop-out positive mask

Blue exposure through drop out positive mask with dense positive tone separation + red exposure through drop out negative of large and fine detail

Blue through dense positive tone separation and combination drop out mask + green and red exposures through negative masks + transparency

Tim Stephens

as in black and white, when working with negative–positive colour paper. But unlike black and white posterization you will need both sets of separations.

Printing lith separations in colour

The key feature of colour posterization is the way the colours mix when successive separations are printed. For black and white posterization, the different sheets of film are each printed as distinct shades of grey. But when you print lith separations on a sheet of colour paper with coloured light, each new exposure combines with those that have already been made to give a new colour where the separations overlap. So every time you add another colour exposure, two more colours are formed—the colour of the exposing light, if you are using positive colour material such a Cibachrome, and a colour formed by the combination of the new colour with the others on the print. If you use positive printing paper and expose each separation to light of the primary colours red, green and blue, the secondary colours yellow, magenta and cyan are formed where the light passed by the various separations overlaps.

In theory, you could end up with red, green, blue, yellow, magenta, cyan and white after only three exposures on positive colour printing paper. In practice, the colours in the final print are usually somewhat degraded when prints are made using a normal colour enlarger with yellow, magenta and cyan filters. The colours may either lack saturation, and tend to be slightly pastel, or else they may be slightly grey. This is not necessarily a disadvantage, since it means that the prints you make have more subtlety than those with brilliantly pure colours. But if you want very pure colours, it is possible to produce them by using tricolour printing techniques. The reason why prints made with the subtractive filters yellow, magenta and cyan have less than perfect purity is because the enlarger filters themselves tend to pass more light than they should. Each subtractive filter has to pass light to expose two layers in the colour print, and it is virtually impossible to make filters with sufficient purity over two parts of the colour spectrum. Red, green and blue primary filters, on the other hand, can be made with the necessary degree of purity. The red made by mixing magenta and yellow, for example, is simply not as pure as that transmitted by a tricolour red filter. Such filters are incorporated in enlargers such as the Philips Tri-One series, and these are therefore ideal for making prints that need very high colour purity. But pure red, green and blue filters made of acetate or gelatin are also available.

Since you need to make a separate exposure through each filter, few printers bother to use them for normal

Green exposure through the green colour separation negative + red exposure through the mid tone tone separation positive. No blue exposure

Blue exposure through red separation negative + green exposure through green separation negative + red exposure through shadow positive

Blue exposure through individual negatives of masks + red exposure through positive fine detail mask + masked normal printing of original

Green exposure through green colour separation negative + red exposure through mid tone tone separation positive + normal printing of slide through mask

colour printing. But colour posterizations require separate exposures in any case, so there is less of a disadvantage in using separate primary filters. It is possible to buy optical quality gelatin primary filters that can be held under the enlarger lens for each exposure. You must be very careful how you handle these filters, since they are easily damaged and almost impossible to clean.

Whether you use red, green and blue or yellow, magenta and cyan filters, the basic working procedure is the same. A sheet of colour paper punched to fit on your register board is exposed by contact printing similarly punched and registered sheets of lith film. Each sheet of film is exposed to light of a different colour, after which the sheet of paper is processed normally. Since enlargers, filters and colour papers vary so much, it is impossible to give precise exposure or filtration recommendations; you must find the correct exposures by trial and error using test strips where necessary. In general, tricolour red, green and blue filters need somewhat longer exposures than those made with subtractive filters because of their more restricted light transmitting properties.

Colour posterization experiments

There is no reason why you should limit your posterizations to those made with only three lith separations from a black and white original, or to those made by printing in three primary colours. For instance, you might try printing two or three separations in different shades of blue by varying the filtration and exposure with only two filters instead of three. Although colour posterization is a relatively complicated process, it does lend itself well to such experiments. Even pictures that do not turn out quite the way you intend are often visually striking. A colour posterization never looks 'normal', so extreme departures from visual reality can be accepted.

When you make a black and white tone separation print, you need only use a set of negative separations. The tones are built up by additive exposures, each of which would produce grey, so that the black areas of the print are the result of these successive grey exposures. However, when you are working in colour, you may need to use both positive and negative separations in combination to have control over the final colours.

For example, think about a colour posterized portrait. The original face may have light tones on the front of the face, middle grey tones on the side, and black hair. If a set of positive separations were printed on reversal colour printing paper, a possible result could be as follows: the positive highlight mask might be printed in green, the middle tone mask in red, and the low tone mask in blue. But only the hair areas would end up with a primary colour—in this case blue. The middle tone areas would have blue plus red exposures, giving magenta, and the highlights would receive all three primary colours, giving plain white. While this could be attractive it might not be what you want.

The answer to the problem is to use negative lith separations as counter-masks to prevent light of unwanted colours from reaching some areas of the print. These must be very precisely registered, otherwise lines of secondary colour may be formed where opaque areas on two masks meet—but once again, this effect may prove to be visually useful. In the example above, the highlight areas on the face could be coloured green by placing a negative mask over the highlight areas after the first exposure is made, and leaving it in place during the subsequent exposures.

Combining lith negatives and positives that do not correspond to each other—for example, a positive shadow density lith and a negative highlight density lith—can lead you to an infinite number of colour and density variations. Such effects can look similar to pseudo-solarization, since they combine both positive and negative areas.

You may only want to print a part of a particular lith negative, or alternatively make a part stand out against a flat background. Although this can be done to a certain extent by normal tone separation, the only way to eliminate a part of a print which is in the same tonal range as the part you want to include is by retouching the negative. A negative treated in this way is in practice a mask, and this technique can be very effective for making the subject stand out.

If, for example, you want to eliminate the background in a portrait, you can block it out by hand with opaque retouching solution. If this is done on one of the separation positives the background will be clear on the negative allowing it to be printed as black or as a flat colour in the final print. If you retouch the negative in this way, the background will print as white in the final print.

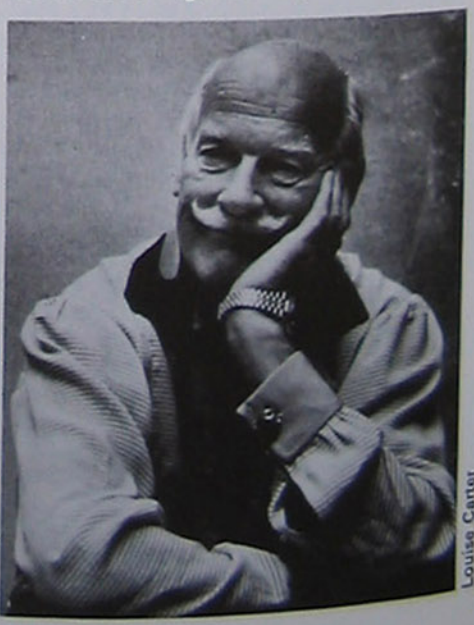
Norman Parkinson

Norman Parkinson © The Condé Nast Publications Ltd.

Painterly touch *Parkinson often refers to the work of artists he admires. Here he pays homage to Van Dongen*

Crane Beach Hotel *A daring model and two small smoke bombs combined to great effect in a recent fashion shot*

Norman Parkinson *puts others at ease but hates having his own photo taken*



Louise Carter

A fashion, portrait and society photographer for 50 years in Europe and America, Norman Parkinson thinks pictures should communicate—and make people smile

After 50 years as a fashion and portrait photographer, during which time his name has become almost a legend, Norman Parkinson has very definite views on photography. Above all, he sees photography as a way of sharing his experiences and making people smile. 'I know I'm crying in the wilderness, but I think that's what photography is about. Through this silly machine we have an ability to communicate and to make people happy.'

It clearly annoys Norman Parkinson that many photographers seem often to forget that this is what their medium is all about, and become bogged down in the technicalities.

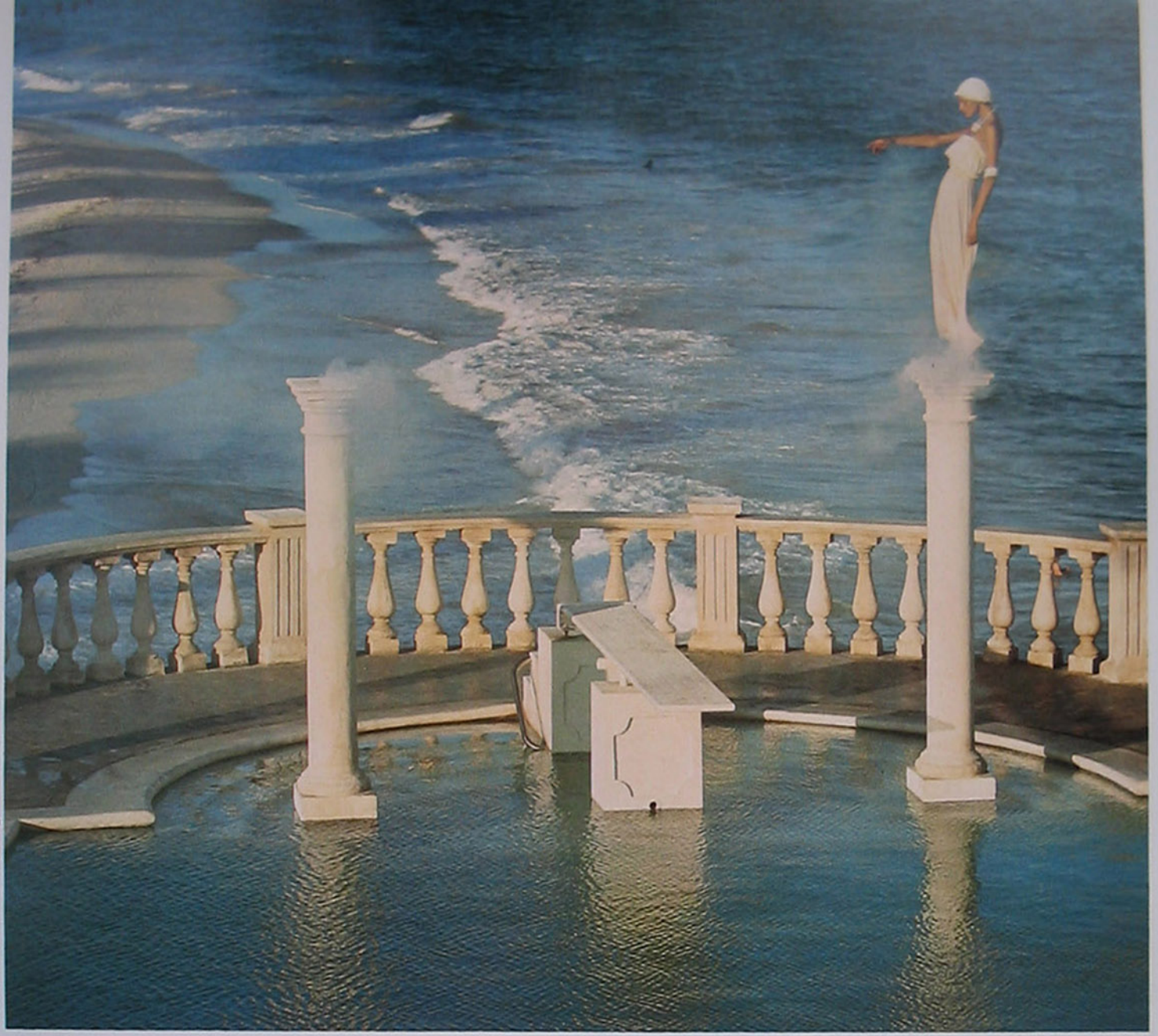
'A photographer is made between the ears—not between the lens and the film. The only point in learning about photography is that when the chance comes to take an important picture, your lack of technique doesn't prevent you from seizing the moment.

'People might think it silly of me to say so, but any third year student up at the Elephant and Castle—the London College of Printing—probably knows more about photography than I do. I mean that quite seriously. I don't know anything about the numbers on lenses, I just say "I want the fat lens or the long one, or not the very wide one, the other one" because I'm concentrating on what I'm trying to take'.

In fact, Norman Parkinson feels that too many technicalities can be a positive drawback when photographing people, interfering with the developing relationship between the photographer and his subject. He feels that people are nervous enough about having their picture taken anyway, and hearing the photographer talk in technicalities increases their apprehension. 'Numbers frighten people. It's almost as bad as lying back in the dentist's chair when you're wondering if you're going to get away without having an injection and the man says "I'll have two milligrams, nurse, please." That's what talking about technicalities does! I know plenty of photographers who look at the person and say "Yes, we need some soft focus here . . ." and you watch the person shrink.'

Parkinson is always concerned to bring out the best in people and to show them in the best possible light. Indeed, he tries to 'inflate' the best. 'It's too easy to photograph the worst—and make people look hideous, isn't it? People that are getting on a bit look dreadful most of the time.'

Because of this attitude and the many glamorous images he has produced, Parkinson has been accused of ignoring reality in his photography. 'I think it's a very valid criticism, that I'm a bit too much into the fantasy. But when I look at



Norman Parkinson/Vogue © The Condé Nast Publications Ltd

newspapers and see that horror and deaths sell them, I think we have a very nasty streak in all of us. I'm inclined to believe that since we're such a terribly long time dead, there's a valid reason for showing a little happiness. Diane Arbus, for instance, is into freaks but I think that there are more beautiful things to photograph. That doesn't make her less good or me less bad.'

Norman Parkinson's own style is difficult to pin down and he regards this as a virtue. 'The nicest compliment was paid to me by a man who was holding a ladder when we were hanging up pictures in the gallery (for an exhibition of his photographs) and he said to me, "Mr Parkinson, this is an exhibition of 20 different photographers". I found that very flattering because it means that my work then cannot be mannered or defined in one particular way.' But if he refuses to define himself, Norman Parkinson has been recognized, defined and acknowledged by others as an innovator throughout his career.

He began his photographic career in 1931, apprenticed to an established and respected firm of court photographers, Speight & Sons of Bond Street, London. He came from a family of farmers and opera singers and says he became a photographer because he was 'scholastically abysmal'. His apprenticeship lasted only two of a planned three years: his ideas did not fit in with the studio's and he was asked to leave. When he left, the studio gave him a reference which said 'one day he will take a good photograph.'

Fortunately, he was not easily put off and soon he opened his own portrait studio. Before long he had made quite a name for himself as a fashion and portrait photographer, working for *Harper's Bazaar* and a society magazine, *The Bystander*. He covered numerous society events and travelled widely on assignments. Today the pictures he took during these early years convey a strong impression of those times.

Surprisingly, perhaps, for someone with the image of a sophisticated society photographer, Parkinson frequently returned to the farm and, when World War 2 came, he combined aerial photography for the Royal Air Force with farming. After the war he joined Condé Nast and worked for both British and American *Vogue* until 1960 when he became a contributing editor of *Queen* magazine. In 1964 he moved to Tobago, to farm again and since then he has worked freelance for many major international magazines including *Vogue*, *Life* and *Elle* as well as for the American magazine *Town and Country*.

He believes the combination of farming and photography is important. 'I think a photographer has to have many, many interests. It's very difficult to work in a vacuum because there's nothing to photograph but the white walls.'

He introduced aspects of the outside world into his fashion pictures very early on. He was virtually the first British photographer to get his models to move and look natural.

'When I started I didn't want to take photographs like anyone else—that was my only criterion. I knew there were a lot of good photographers about. But important people like Steichen and André Durst only seemed to photograph "evening dresses" or "day dresses" or "cocktail dresses" in very soigné,

Hat fashions *Much of Parkinson's work, like this 1949 shot in New York (over), is particularly evocative of its era*

Overleaf—Norman Parkinson/Courtesy Vogue © 1949 (1977 renewed) by the Condé Nast Publications Inc

Norman Parkinson/Vogue © The Condé Nast Publications Ltd

Dog Friday *This 1971 shot in the Seychelles has a lucky extra—the dog appeared unexpectedly just when needed*

Golfing at Le Touquet *A fashion picture from 1939, which already bears the Parkinson hallmark of action outdoors*

scent-laden locations.

'I suddenly thought to myself, "girls wear overcoats, girls wear tweed suits, girls wear swimsuits or whatever. Why don't we take them out and photograph them in their natural habitat?" That's how that all happened. I photographed people on stations. I photographed them playing leap-frog over sheaves of corn that were stacked in the fields. I was after a sort of realism. I lived in the country and this is the way I saw girls behaving.' According to him the results had a rather dramatic effect on the people photographed. 'All the models that I discovered are now duchesses!'

Even now he would rather not use a studio if possible. He prefers natural light. He also prefers not to use models: 'I've rather grown out of models—I like photographing people. It's not that models aren't people, but I don't like a model looking at me thinking "mmn he's not as good as Bloggins" or "his light isn't half as good as Harry's".'

He also feels professional models acquire certain mannerisms which limit their spontaneity. 'If a girl works for eight or ten big-time photographers, she'll smile and give you the whole gamut of the last three or four photographers she has worked with. The biggest charge I get out of photographing models is perhaps with a girl who's never been photographed before. They come in all gangling and say "what should I do?" and that individuality is exactly what's right.'

His idea of a favourite assignment is 'anything which allows me to travel. I'd go anywhere! Well, I wouldn't like to go to the South Pole—I'm much better off in the sun.'

He singles out a trip to the Seychelles in the early 1970s as a particular favourite. 'It was nice because I was really the first photographer to go there. I took a model who is a very courageous girl and we had a lot of brave things to do. We had to climb ashore with cameras, in big surf from rubber boats and all that kind of thing. The nice thing about it was that not only was the model good and co-operative but so was the location—it hadn't even been photographed before.'

For the Seychelles assignment, he was given the kind of vague brief that he likes. More importantly, he was able to work with an absolute minimum of assistance. This is very important to Parkinson, and goes some way to explaining his preference for editorial work—fashion shots for a magazine, for instance—over advertising shots. With editorial work, far fewer people are involved in the session and he can work much faster.

Norman Parkinson/Reproduced by kind courtesy of Harpers Bazaar

Norman Parkinson/Vogue © The Condé Nast Publications Ltd

Country bar *In 1951 Parkinson challenged fashion conventions by posing his wife, Wenda Rogerson, in twinset and pearls in a country pub bar. She appears again, remote from everyday life, in a satin Molyneux evening dress*

'If I go off on an editorial day, it's me, and my assistant, and maybe a fashion editor. We get dressed quickly and we go—boom boom. I have taken enough pictures for 30 magazine pages in a single day. Editorial is freer, you don't have the cumbersome, juggernautish progress of a heavy advertising session,' though he does point out that an advertising shot can pay ten times as much as an editorial shot.

'In an advertising session there can be more than a dozen people involved. They have to impress the client . . . its "we've got Parkinson, so we need a hairdresser, a hairdresser's assistant, a makeup artist, a studio just in case it rains, a fleet of cars (to go nowhere)" . . . and so the whole thing is built up and becomes very expensive. Although I might get so much for my shot, the extras multiply the cost by three or four times. So, when the thing appears, the client has to be impressed because it has cost so much!'

His flexible approach to work, and to fashion pictures in particular, showed when he was asked his view on what makes a good fashion photograph. 'How can I possibly answer that? There are so many conditions—it depends on the magazine, whether it is editorial or advertising . . . many things. You can't say "a good fashion photograph shows the dress, a pretty girl standing up with nicely done hair and so on." The approach must suit the magazine. If you were working for *Elle* or *Mademoiselle* you would choose a 16 or 17 year old girl, preferably who looked a bit like a lunatic and you would lie her on the floor. The dress would be fairly scrunched up, but there would be nice ingredients and she would have a certain appeal. If you were going for American *Vogue*, then there would have to be a lot of lovely skin and hair quality, T-E-E-T-H and clean living. It just depends who you're working for and what you're trying to sell in the picture.

Official 80th Birthday Photograph

'If you're working for designers, photographing the collections, then I make a point of trying to show the clothes more carefully. If a garment costs £1000, I think you have a responsibility to make it look at least £400!'

Parkinson has always preferred to work in colour. 'I'm sure that the best photographers all use black and white, but I knew I dreamt in colour and for me colour has always held more magic.' In the late 1930s his 35 mm Kodachrome pictures were among the first colour work to appear in the British edition of *Harper's Bazaar* and, through his work for *Vogue*, Parkinson has become one of the world's best known colour photographers.

But despite his preference for colour he has taken many successful photographs in black and white.

Parkinson's photographs were shown in an extremely successful exhibition at the National Portrait Gallery, London. In the first week it was on, over 12,000 people flocked to the show.

Parkinson himself felt very proud to have his work so exhibited. 'I'm enough of an old English traditionalist to be very pleased to have an exhibition among these hallowed walls. You might say I'm sorry that my mum and dad are dead because this idiot son of theirs has done something that would have pleased them.'

Queen Mother *Among Parkinson's best known portraits are informal views of members of the British royal family*

Understanding...

How emulsions are made

Photographic film looks very simple. But modern materials are actually quite complex, and their manufacture involves several complicated and critical processes

At first sight there appear to be many differences between the various types of photographic film and paper, particularly between black and white and colour. But all photographic emulsions have the same basic structure, and consist mainly of light sensitive silver salts.

These salts are in the form of huge numbers of tiny crystals which are spread uniformly throughout a binding agent, usually a thin layer of gelatin (see page 422). The basic structure is added to or modified in various ways to produce the different kinds of emulsion, but the principle is always the same.

Gelatin is made from the hides and hooves of cattle, and has many properties that make it ideal as a medium for carrying the light sensitive silver halides. For example, when the emulsion is immersed in water, the gelatin expands. As it does this, it soaks up the water, along with anything that might be dissolved in it, such as developer.

The gelatin is very similar to that used for making table jellies, except that it is of a much higher quality. The manufacturer receives it in the form of pellets of fairly uniform size. When these are steeped in cold water they absorb it and swell. When the water temperature is raised to just above blood heat (around 38°C) the gelatin dissolves in the water to form a thin liquid glue known as a *sol*.

In the making of an emulsion, a gelatin sol is prepared in which an alkali halide—such as ammonium bromide—has been dissolved. To this is added a silver nitrate solution, which reacts with the halide in a process of *double decomposition*, forming silver halide and a soluble nitrate, and so producing the basic emulsion.

courtesy of Eastman Kodak Co.

Mixing the emulsion *Solutions of gelatin, silver nitrate, halides and other chemicals are mixed together in steel 'kettles' to produce the photographic emulsion*

Ripening

The emulsion mixed in this way is then maintained at a temperature of about 55°C for 30 to 60 minutes. This is the *first* or *Ostwald ripening*, and is largely responsible for the characteristics of the emulsion in terms of speed, graininess and contrast.

During this time, the halide crystals increase in size and are reduced in number, due to small crystals dissolving and reforming on the larger ones. Thus the larger crystals grow at the expense of the smaller ones. This results in an increase in the speed of the emulsion, as light sensitivity is very much dependant on crystal size. The longer this ripening process is allowed to go on, the faster the resulting emulsion will be. Slow emulsions are ripened for only a short time, or not at all.

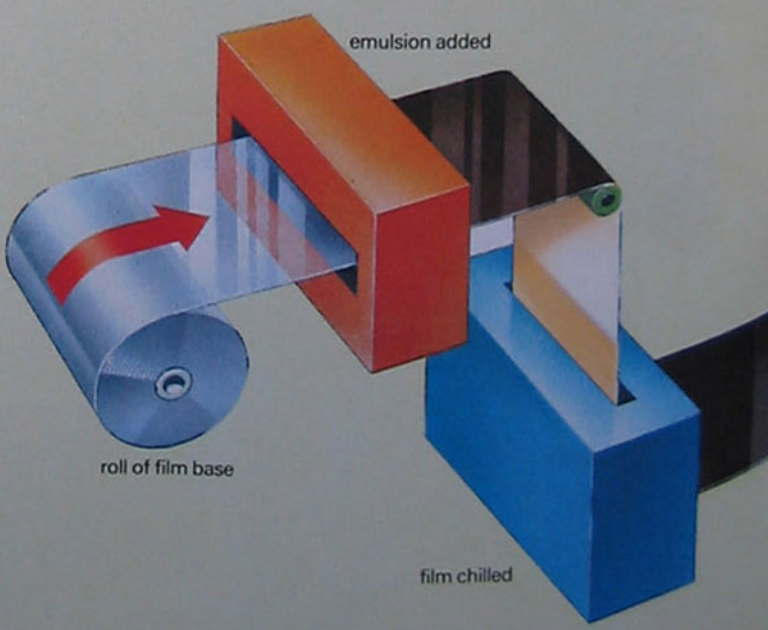
Following the ripening process, the emulsion is washed to remove the excess soluble halides and nitrates resulting from the double decomposition. This is traditionally done by setting the emulsion by chilling it, shredding it and then washing in water. Recently, other methods have been developed, such as adding a coagulant to the solution so that the emulsion settles to the bottom. The excess liquid is then drained off.

Following this, another ripening process takes place, known as *after ripening* or *digestion*. This has no effect on crystal sizes, but it has considerable effect in increasing emulsion speed. It does this by promoting the formation of specks of silver sulphide—sensitivity specks—on the surfaces of the halide crystals. These specks form the basis of the exposed image, and their formation is aided by the fact that certain types of gelatin contain small quantities of sulphur compounds which come from the mustard for which cows have a fondness.

The after ripening process has to be carefully controlled. Speed and contrast increase to a maximum during this process, but after a certain point fog increases rapidly and contrast drops. Some control can be achieved by the use of specific types of gelatin and additives.

The completed emulsion then has sensitizing dyes added to produce orthochromatic or panchromatic spectral sensitivity and gold

Film coating



Advertising Arts

salts are often used to further increase the speed. Preservatives, hardeners and other chemicals may be added to improve the emulsion's keeping properties and aid the coating process.

In preparation for coating, the emulsion is melted and various solutions known as 'doctors' are added. Alcohol may be included to reduce frothing, glycerin to make the dried emulsion layer pliable, and surface tension reducing agents to make the coated emulsion readily wetted by processing solutions.

Coating

When the emulsion is ready it is coated on a film or paper base, using a variety of methods. In the case of films a polyester base is now often used, replacing acetate, which is brittle, and celluloid (cellulose nitrate), which was flammable. To ensure good adhesion a special *subbing* layer is applied to the base before the emulsion is coated on to it. This aids stability during the use, processing and storage of the film.

With some films—notably sheet films—an anticurl and antihalation backing is applied, and this again uses a subbing layer to provide maximum adhesion.

Finally, another important layer known as the *supercoat* is placed on top of the emulsion. This is a layer of hard gelatin which protects the emulsion from the effects of abrasion. Rubbing or scratching an unprotected emulsion can make unexposed silver halides near the surface developable. This can lead to random silver deposits known as *stress marks* in the final image.

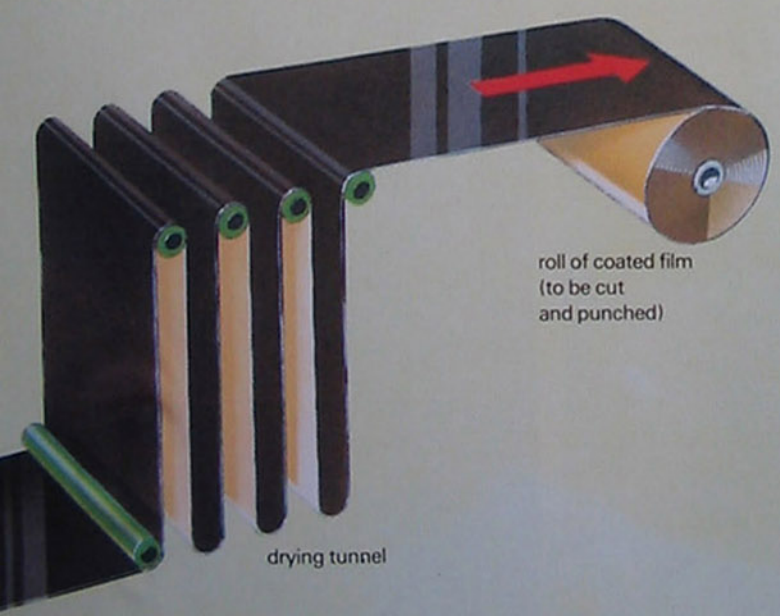
Further complications

The above procedure is the method for producing a basic monochrome film. In fact, the manufacture of modern films is far more complicated. To achieve particular speed, grain and contrast characteristics the emulsion may be coated on to the film base in separate layers, or mixtures of different emulsions may be used.

Colour materials involve even more stages. These have a basic structure of three emulsion layers, which have different speeds and spectral sensitivities, and which also contain compounds known as colour couplers. These react with the by-products of the colour developer to form image dyes—a different colour in each layer. Often, these emulsion layers are divided into two or three parts of different sensitivities, which further complicates the emulsion chemist's task.

courtesy of Eastman Kodak Co.

Film layers *The diagram above shows the layers of a basic black and white film. With colour films, however, the structure is far more complicated. This can be seen in the photomicrograph of a cross-section through Kodacolor 400 colour negative film (top), magnified nearly 1400 times to show the light sensitive and spacing layers*



The making of a film *This greatly simplified diagram shows the basic steps in the manufacture of a film. Actually coating the emulsion on to the film base is achieved in a variety of ways and may be repeated several times, especially with colour films. The film is usually made in wide rolls and then cut to the appropriate size*

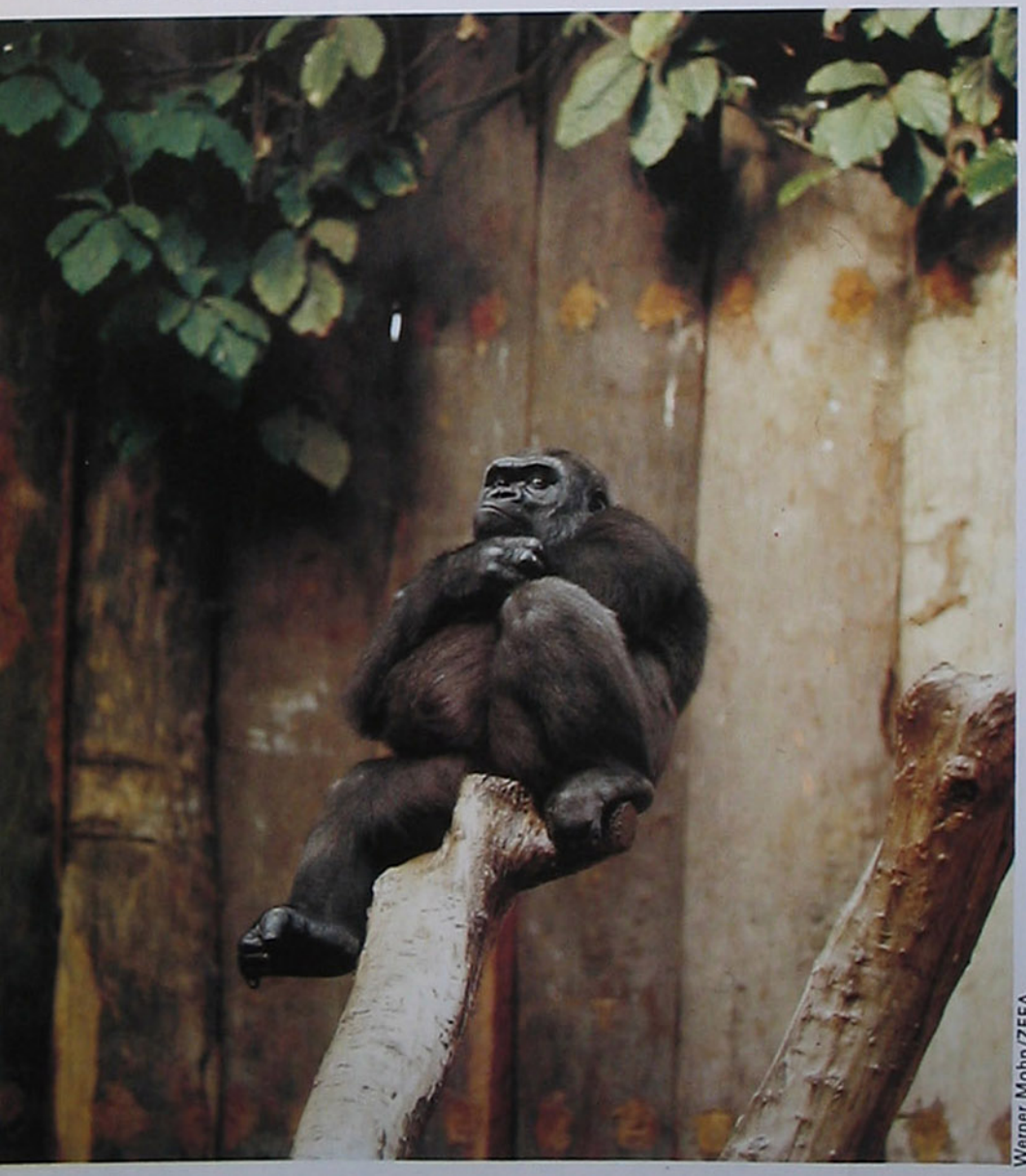
Zoos

Few people have the chance to photograph animals in the wild, but with a little imagination you can take some marvellous pictures of different species in the zoo

As more and more zoos replace barred cages with open compounds, the opportunities for good animal photographs increase. Rather than settle for a simple record shot of a creature doing nothing very much in patently artificial surroundings, you can now, in most large public zoos, explore more creative approaches. On a day's visit to the zoo, you should be able to manage, with careful planning, a few shots that are almost as natural as those that can be taken in the wild, several that show some interesting behaviour, a number of close portraits, and probably one or two of animals reacting to their keepers or the members of the public.

Quite recently there has been a major shift in the ways that zoos are built and run, and as a result photography has benefited, however incidentally. This is the first principle to bear in mind when you visit any zoo: the one factor that determines whether or not you can make strong, creative images is how the animals are displayed. The most rare, interesting or visually attractive creature is only a worthwhile subject for your camera if you can get a good view of it, and achieving this is the essential creative technique in zoo photography.

Concern for the animal's welfare and a realization of the urgent need to breed species that are threatened with extinction in the wild have together resulted in a new style of zoo enclosure. To relieve stress (a tiger pacing across its small cage is not displaying natural behaviour but reacting to an environment that anyone would find unpleasant) and to allow behaviour that is sufficiently normal to encourage breeding, these new enclosures are unbarred and have a setting that often resembles the original habitat in some way. This, fortunately, also gives the public a better view, and although many animals must at times be completely isolated from their audience to allow them to breed and raise young, the net



Werner Mohn/ZEFA

Kenneth W. Fink/Ardea Photographics

Lions cubs *At a safari park a telephoto lens is essential if you want to take close-ups of animals at a distance*

Zebras *By choosing your moment you can turn an otherwise ordinary shot into a pattern*

Armstrong Roberts/ZEFA

Toothy grin *Pictures of crocodiles are made all the easier by the fact that they often remain motionless*

effect has been that everyone has benefited, particularly photographers. Many zoos now have at least some compounds that offer views so naturalistic that photographs taken there can be virtually indistinguishable from those taken in the wild. Naturally, some zoos have always been better than others in this respect, but the majority now follow this idea. Another popular trend has been the growth of wildlife parks—private zoos where herds of animals are able to run free over large areas of parkland, though not usually with the same vegetation as their natural habitat.

Even though taking pictures in a zoo is not a substitute for shooting in the wild, it does have its own special advantages and opportunities. Foremost among these is that the animals are accessible. The alternative to photographing some zoo animals would be to mount an expedition, and in the case of those that are rare or live in areas where photography is difficult, such as a rainforest, a zoo is virtually the only opportunity that you could have of seeing them. In the wild, the majority of animals will not tolerate a close approach by a human, certainly not as close as you can stand outside a zoo compound. This proximity also makes it possible to take detailed portraits—with shy animals, such as gazelles, there is often no other way.

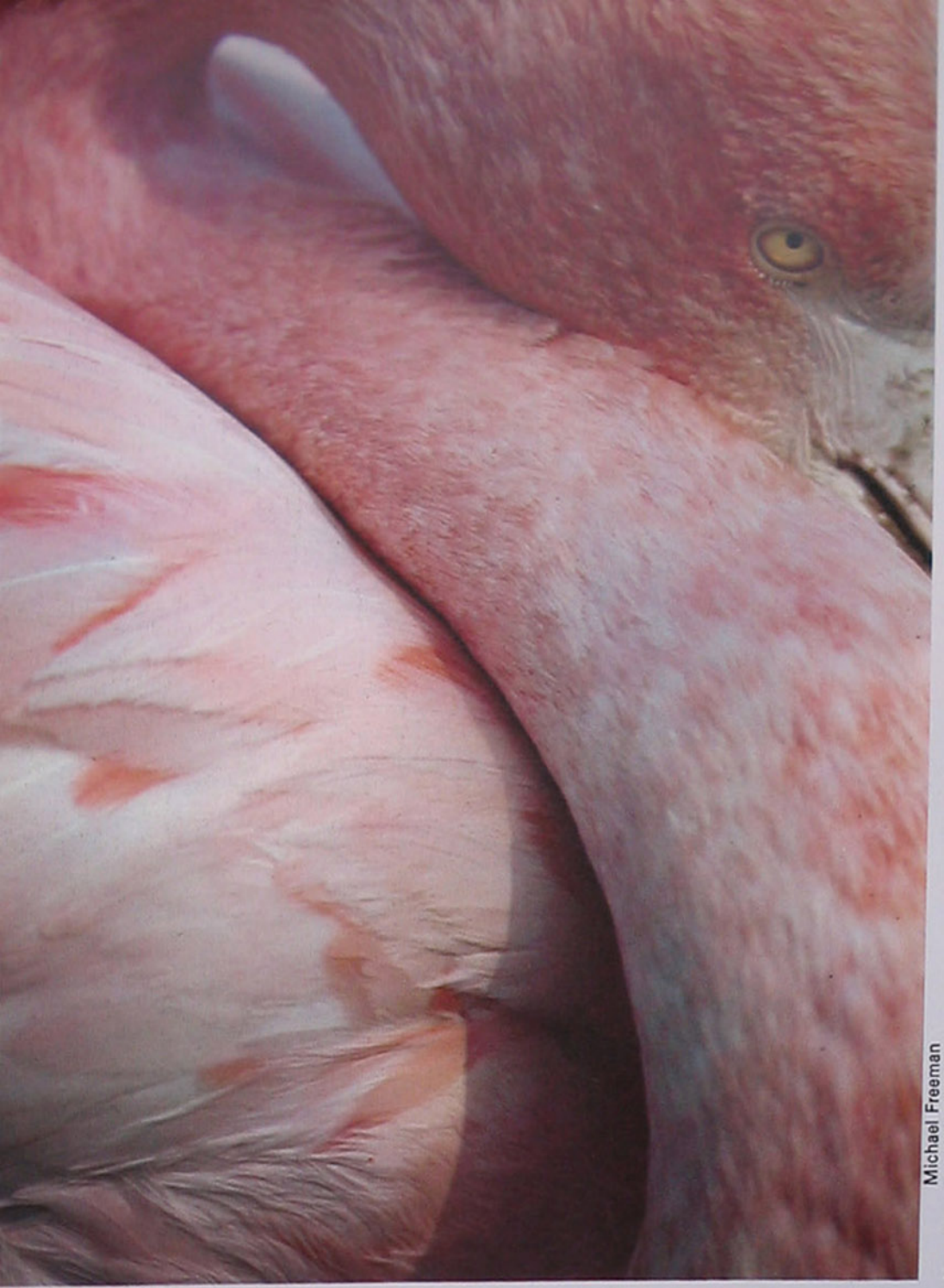
An advantage that is less immediately obvious, but extremely important, is the condition of specimens in zoos. In a well-run zoo, most animals reach a state of health which is far better than they would in the wild; not only is there sufficient food, but there is less chance of the physical injury which comes from attacks by predators and aggressive displays to rivals.

What you cannot expect is that captive animals will show the same patterns of behaviour that they would in the wild, and if you are setting out to take photographs in such a way that the zoo itself does not appear in the picture, be careful not to misinterpret the kind of behaviour you may find. Imagine, for

Graham Tucker

Reinhard—Tierphoto/ZEFA

Orang utans *In this picture a tight crop shows up the extraordinary gestures of these two animals*



Sea-lion *A simple head and shoulders portrait of an animal and its natural environment can be very effective*

Michael Freeman

instance, that some children are, hammering on the bars of a chimpanzee enclosure to attract the attention of the animals: one of the chimpanzees then responds by pulling his lips back into a big toothy grin. This may look for all the world like a good-natured response, but the animal is, in fact, showing stress and anger at potential enemies.

Broadly, there are three creative approaches to zoo photography: you can aim for a naturalistic treatment, choosing your viewpoint and framing so that the setting resembles the animal's natural habitat; you can opt for a portrait, concentrating on details and expression; or, as a third alternative, you can step back from the individual animal as a focus of attention to include its zoo surroundings and the public who have come to see it.

Of these three approaches, the most interesting, and difficult, is the natural-

Flamingo *With a telephoto you can exclude all distractions to reveal details such as line and texture*

istic view. It depends, more than anything else, on the type of enclosure that the zoo has provided—with the best camera technique possible, a plain barred cage offers no opportunities for realism. The first step, therefore, is to choose your zoo. Some have more naturalistic enclosures than others, and this is not necessarily related to how well-managed they are. Some of the world's least sophisticated zoos have the most realistic settings. Your choice is not restricted to the zoo nearest to where you live; if you take a holiday abroad, make enquiries at the local tourist office. Zoos that specialize in native fauna are often the best from a foreign visitor's point of view, not least because they find it easy to provide a natural habitat. A surprising-

ly high number of published photographs that appear to have been taken in the wild have been taken under just such circumstances.

Within each zoo, some species tend to be housed more naturalistically than others. Because of considerations of scale, small creatures such as lizards and insects often have good settings, while animals such as elephants and giraffes are simply too large to appear in an enclosure that attempts to reproduce their habitat. As a group, water-dwellers often make good subjects, because it is relatively easy to construct a natural-looking pond for alligators, crocodiles, turtles, otters and the like.

Sometimes, particularly with small indoor specimens, the vegetation and

Carl Purcell/Colorific

Fritz Walther/ZEFA

other elements will actually be authentic and may, in extreme cases, have been brought from the animal's locality by the collector. On a large scale, one of the most impressive examples of this thoroughness is a small zoo in Florida, called Monkey Jungle, where the entire area has been stocked with Amazonian flora. However, for most photographic purposes, less authentic surroundings are quite acceptable.

Moreover, with a careful choice of lens and depth of field, even many artificial backdrops can be handled in such a way that they are not obvious. Chamois, Ibex and other similar mountain animals are often housed on artificial rock faces, generally of concrete, but if you can frame the animal in such a way that the 'rock' is not quite sharp enough in the picture to reveal its artificial texture, the effect is likely to be remarkably convincing.

Framing and choice of lens does, in fact, play a large part in the success of naturalistic zoo photography. Whatever else happens inside the picture area, you should check carefully for any telltale signs of the zoo or public—reflections of bars in water, sweet wrappers dropped by children, people visible through gaps in foliage, and so on. With any enclosure that seems at first glance to have good possibilities, check all the camera positions and the angles of view. If the setting is very realistic—say, with a good deal of vegetation—then you may be able to use a lens with a standard focal length. Tightly cropped long focus shots are so often necessary in zoos that any opportunity to add variety is worth seizing, but the field of view has to be clear. Long focus lenses have the advantage of being selective, and of having a limited depth of field. This depth of field is useful when you wish to throw the background out of focus, which can make artificial elements unnoticeable, and can also, on occasion, help to defocus foreground obstructions, such as wire netting.

After you have made a reconnaissance of the setting, you can concentrate on the animal itself, and here lies the real skill of zoo photography. Despite the pleasure and ease of taking pictures of handsome creatures basking in well-fed repose, what distinguishes the good animal photograph from the average is an insight into the creature's life or a char-

Michael Freeman

The monkey's paw *A carefully selected detail often makes a good picture, as well as a comment on caged animals*

Polar bears *It is best to throw an unattractive background out of focus, leaving the subject to stand out clearly*

Bill Holden/The Photographers' Library

The peanut *You do not need to show the entire animal—in this case a giraffe—for a good shot*

acteristic gesture. Animals in zoos, by the nature of their captivity, spend most of their time doing very little, and unless you wait for something unusual, results would probably be a series of static and unremarkable images. With planning and some patience, however, you can aim for photographs that show animal behaviour, whether it is as exciting as a territorial or courtship display or as predictable as eating. Even a shot of a tiger yawning or scratching itself is better than one of statuesque drowsiness.

Certain times of the zoo day offer better opportunities than others—most animals are more active in the early morning and late afternoon, particularly the former, while midday is usually a time for resting. Scheduled feeding times are obvious occasions to concentrate on, and these are usually published on signs around the zoo. In small zoos, it may be worth talking to the keepers—if there are not many other people about, you may find them willing to give you a special performance. In any event, an animal's keeper will know its special traits and habits and can give you valuable advice. If you want to become seriously involved in photographing animals in zoos, there is often a zoo society that you can join; among other benefits, the membership fee may give you access at times when the zoo is closed to the public. Time of year is also important—in winter in temperate climates, for instance, many animals are removed to their indoor quarters, while spring usually brings a crop of newly born, always worth a photograph.

Juliet Greene/JS Library International

Giraffes *If the enclosure is as attractive as this one at London Zoo, it is worth making a feature of it*

Rosmarie Pierer/ZEFA

Children and penguins *A well composed picture—the colourful group of children leads the eye into the subject*

An alternative approach is a head-and-shoulders portrait, for which a zoo is the ideal place. Usually this calls for a long focus lens to fill the frame, and a tight composition that will help you to exclude a distracting background from the picture. The facial expression, as in any human portrait, is crucial to the success of this type of photograph; just as with naturalistic zoo photographs, try and capture some animation. This will probably involve waiting for at least a few minutes, and there are animals whose stoic expression hardly ever seems to change on some days, but the difference between a wooden portrait and one where the animal displays some personality is great enough to justify the demands on your patience. With some creatures there may be an opportunity for a more creative composition, focusing attention on such details as the teeth of a crocodile, or the convoluted pattern of neck and feathers as a flamingo sinks its head into its body.

The quality of the lighting is important for all photography in the zoo, especially for portraits. In indoor settings, such as the reptile house, portable flash is normally essential (although not always permitted—check first), and as there is usually no opportunity to manipulate this light by bouncing it off reflective surfaces, the technique is fairly straightforward. Most of the small indoor settings

are behind glass, for which there are two technical precautions. First, position the flash and camera so that no light is reflected back into the lens (the simplest way is to mount the flash unit on the camera and shoot at an angle through the glass). Second, because some of the flash illumination will be lost as it passes through the glass, particularly the thick plate glass used in vivaria for large reptiles, you may need to open the aperture by half or one stop to allow for this. The direct flash technique indoors does not leave much scope for creative variations, but with close-ups of small creatures it is usually satisfactory.

In the outdoor sections of the zoo, however, waiting for the right natural lighting can pay dividends. On a sunny day, make a quick survey of the enclosures when you arrive, using a zoo plan in the case of a large zoo, and work out how the light will strike different parts throughout the day. A low sun may give good opportunities for spotlighting an animal against a dark background, and occasionally the chance of a backlit portrait.

The third quite different creative approach is to show a relationship between the animals and their zoo surroundings—the way a seal reacts to its keeper entering with a bucket of fish, or an elephant perched on the lip of its moat, trunk fully stretched out towards a child offering some food. If you have children yourself, a day's outing is a marvellous opportunity to photograph them, and many zoos have a children's section, with domestic and trained animals.

William S. Paton/Nature Photographers Ltd.

Macaw *A dark background emphasizes the vivid colours and curving shapes of this beautiful bird*

Panther *Try to catch animals when they have an interesting expression, and then frame carefully*

Lazo Lemoin/ZEFA

Shooting through telescopes

Very long focus lenses are expensive and rarely used. But you can get good results from a DIY set-up that allows you to photograph through either a telescope or a pair of binoculars

Super-telephoto lenses produce dramatic images which seem to cut across long distances, flattening far off objects into a bold pattern of shapes. But for most people, the cost of the really long telephotos puts them out of reach, and their weight and bulk make them unwieldy to use. The largest ones are not even designed to be particularly portable—they work best from a fixed plinth.

Many photographers, though, own a telescope or a pair of binoculars, and these can easily be pressed into service to take the kind of photographs that are usually associated with much more expensive super-telephotos. Furthermore, they are more portable than conventional long lenses, and produce the maximum image magnification at the minimum cost.

Jerry Young

Concorde *Extremely long focal lengths—such as the 1200 mm lens used for this shot—allow you to photograph otherwise inaccessible subjects with dramatic effects*

Quick and simple

The easiest way to link a camera to binoculars or a telescope is simply to put the camera, with its standard lens, against the eyepiece, where you would normally have your eye. This technique is known as *afocal photography*, and in this case the optical system works in the same way as the front-of-lens converters shown on page 659.

There are several advantages to this method: no modifications are needed to any of the components of the system, it costs very little to set up, and a rigid support for the camera is not necessary—it is even possible to hand hold it if need be. A mount for the telescope or binoculars is needed, but this can be made at home from plywood, and bolted on to a tripod. Some telescopes have their own tripod mount, making this unnecessary, and special clamps can be purchased to hold binoculars to a tripod.

In use, the telescope or binoculars are first lined up on the object to be photographed, and focused in the usual way. The camera is then brought into position behind the eyepiece, and the camera

Adapting for binoculars

1. *The first step is to cut a baseboard and to drill a hole for the bolt which will hold the camera in place*

2. *Cut a hole in the blank plastic sheet from a filter system. It should be a snug fit over the eyepiece*

lens focused on infinity—binoculars and telescopes are designed to be used with the eye at rest, and when correctly adjusted they always form an image which appears to be at infinity, regardless of how far away the subject is.

Not all users focus optical instruments correctly, but there is a simple way of making sure that a telescope or binoculars are focused on infinity. In the case of a telescope, look through the eyepiece with one eye, but keep the other eye open. Focus the telescope until you can see both the real and the telescope image sharply. If you normally wear spectacles, keep them on for this test. It does not matter if you can only see a small part of the image.

For binoculars, focus the half of the instrument that you plan to use in this way, before going any further.

If you follow this procedure, you do not even need to use an SLR camera, because focusing and framing are done before the camera is moved into position. A simple camera may in fact produce better pictures, because the uncomplicated design of the lens on a cheaper camera is often more compatible with the optics of a telescope or binoculars than the five or six element designs found on most SLRs.

In fact, the ideal camera to use is a rangefinder or twin lens reflex type. Such cameras usually have comparatively straightforward lenses of small maximum aperture and have no moving mirror to cause vibration. The large maximum aperture that is essential for focusing with an SLR becomes a liability in afocal photography, because to provide a distortion-free image, the manufacturers use five or six glass elements, well spaced out. This arrangement, when applied to the eyepiece, causes vignetting—your pictures look as if they are taken down a cardboard tube. If your only available lens is of this type, the best solution is to confine the subject to the centre of the frame, and crop off the dark edges of the picture at the printing stage if this is possible.

In practice

While it is possible to hold the camera up to the eyepiece and line it up by eye, it is preferable to have the camera and optical system firmly fixed together. It is unlikely that the telescope or binocular manufacturers will supply a ready-made adapter which allows you to fit your camera directly to the eyepiece of a telescope or binoculars, so usually you will need to make an adapter yourself. The simplest way to do this is to buy one of the popular 'creative' filter systems, and adapt the rigid black plastic sheet—supplied for use as a lens cap—to hold the camera lens close to the eyepiece.

Make a large hole in the centre of this plastic sheet, and use a round file to ream it out until it fits neatly over the eyepiece. Slide the plastic sheet into the holder, and check for fit. When the eyepiece is inserted into the round hole, and the filter holder attached to the lens, the front element of the lens should be as close as possible to the rear element of the eyepiece, without actually touching it. The whole assembly must be centred as carefully as possible—the centre of the eyepiece should be perfectly aligned with the centre of the camera lens.

When you have arranged the fit as well as you can, dismantle the adapter, and glue the black sheet into the holder, using a 'superglue' or epoxy adhesive. Ideally the eyepiece should also be glued into place, but this is not essential, and you can probably get away with a push-fit.

Whether you use a purpose-built adapter, or a home made one, you will need to hold the entire set-up steady. The best way of doing this is to mount everything on to a baseboard. A suitable material for making a baseboard is plywood, about 1 cm thick. This is rigid and easy to work with. Start by drilling a hole at one end so that you can mount the camera on the board with a tripod screw—a ¼ inch Whitworth bolt. Take care that this bolt does not protrude more than 5 mm from the board, or there is a danger that you will damage the camera's tripod bush by overtightening. Lay the binoculars or telescope down on the board, and align the various parts of the system using packing material such as pieces of card or thin wood. When you have established the amount of packing material needed, and where it should be placed, glue it into position.

Michael Maunder

Full moon *photographed through a 16 × 50 binocular set-up*

3. Use shims of card or wood to align the camera and binoculars and then glue them in place

4. You can now glue the black sheet into its holder to preserve the correct alignment

Roger Payling

continued

To prevent the binoculars or telescope from sliding around, hold them down with heavy gauge rubber bands.

Finally, find the point of balance and drill a hole in the baseboard at that point. Tap or glue a ¼ inch Whitworth nut into the hole so that the unit can be fixed to a tripod.

Although somewhat ungainly, this set up works well, provided that there is enough play in the system to allow the units to be focused, and that no light can enter between the eyepiece and lens. Light leaks can be eliminated by draping a large piece of black cloth over the whole apparatus.

Other methods

Afocal photography is not the only way to use a camera with a telescope or binoculars. By removing the camera lens and the eyepiece of the other unit, you can project images directly into the camera body. This system, known as direct projection, is really only useful for photography with astronomical telescopes, though, and is dealt with in a subsequent article.

Eyepiece projection is a third method, and is identical to direct projection except that the eyepiece on the binocular or telescope is retained. High magnifications are possible by increasing the separation between the two components, but the system is of limited practical use—stray light is a problem, the aperture is very small, and all the units must be rigidly clamped together.

Making exposures

The restrictions that apply to ordinary super-telephoto lenses also make photography through binoculars or a telescope difficult. Atmospheric haze and turbulence can reduce definition and hinder focusing when the subject is very distant, and it is best to concentrate on photographing things which are quite close—less than a kilometre away. At the other extreme, you may be interested in photographing the moon or stars, though this calls for special techniques because of the Earth's rotation, and is discussed subsequently.

Michael Maunder

Eclipse *The total solar eclipse of February 1980, photographed from Kenya using apparatus similar to that shown below*

Try to avoid using the focusing system of the camera if you can. The split image rangefinder and microprisms black out when used at high magnifications, and although the procedure of focusing by eye and then moving the camera into place is tedious, it is the surest way of getting sharp pictures. Because the working aperture of the combination of lenses is quite small, the focusing screen of an SLR goes very dark, and it is difficult to detect when a subject is in focus.

If you must use the camera's focusing screen—for example, when the subject is moving—a simple method of increasing screen brightness is to dab a small quantity of distilled water on it through the lens mount, with the lens removed. Light transmission increases dramatically—sometimes the screen image becomes eight times as bright. The water quickly evaporates, and if it is confined to the centre of the screen, it should do no damage. A more permanent solution is to use a drop of oil, though this can be very difficult to remove.

The amount of exposure that you will need to give for any particular subject depends not only on the subject brightness, but also on the effective aperture of the set-up that you are using. If your camera has a through-the-lens exposure meter, you should have no trouble measuring the exposure—use the meter in the stopped-down mode. If it does not, then you will have to make a series of test exposures. If you are using a 50 mm camera lens at full aperture and 8 × 30 binoculars, a good starting point is about *f*/16. This is the effective aperture of the whole system and is fixed, so exposure must be controlled using the shutter speed. Closing down the aperture of the camera lens only has the effect of increasing vignetting.

Apart from these operational problems encountered with combinations of camera and binoculars or telescope, pictures can be taken in very much the same way as they are with a conventional telephoto lens. More information on this subject is given on pages 585 to 589.

WARNING

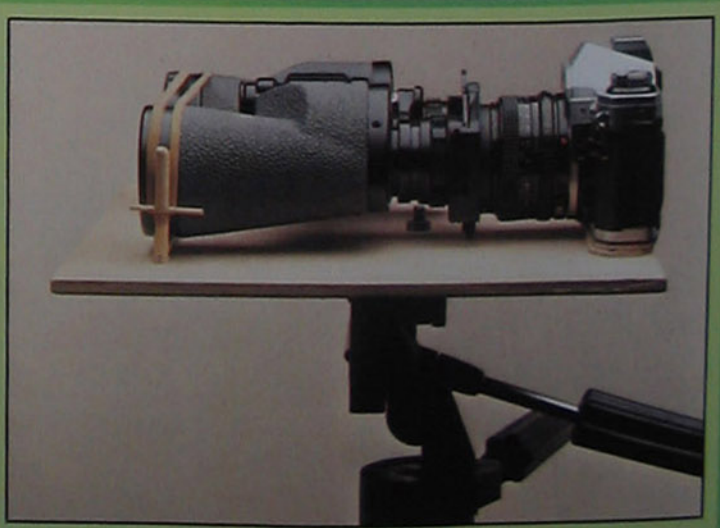
Never under any circumstances whatever attempt to view or photograph the sun with any of the set-ups described in the text without the correct high density absorbing filter over the lens.

Not all the filters on sale are safe, and many are easily damaged by use. You must seek expert advice first and the best way to do this is to contact your local astronomical society.

The only safe way to view and photograph the sun is by projection on to a screen. This reduces the light to a safe level. It may also be possible to photograph it when the sun is very close to the horizon at sunrise or sunset, but only when the disc is comfortable to view with the naked eye. Do not attempt it at any other time or you run the risk of permanently damaging your cameras or your eyesight.

Roger Payling

5. *The binoculars are held very simply by a rubber band. The dowelling also keeps them closely in line*



6. *The finished assembly can be mounted on a tripod—but be sure to drill the hole at the balance point*

What went wrong?

Telephoto shots

Telephoto lenses magnify the subject for a frame filling picture—but they can also magnify any faults in your technique

Not all lenses are capable of sharp results—this picture was taken with a low cost telephoto lens. Even though a tripod and fast shutter speed were used, the focused image is unsharp

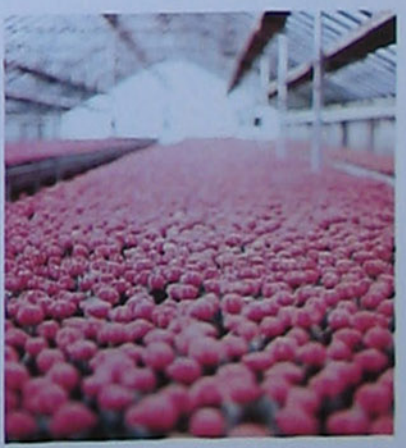
At fairly close subject distances you must be careful in using the available depth of field, even in very bright sunlight. Use your preview button or depth of field scales to check focus

Because a telephoto brings the subject close, you may not notice obstructions such as the greatly out of focus blur of a spectator when taking the shot—so check that the field of view is clear

Lightweight or table-top tripods are not suitable for supporting heavy cameras and lenses, especially if slow speeds are used and no precautions are taken to eliminate camera shake. Unsharpness (above) can be avoided by using a combination of self-timer, mirror lock-up and cable release

Although intentional in some lenses, a focus movement which continues past infinity—as on the 400 mm lens used here—leads to pictures which have nothing in focus. Check the focus, even for distant views

Out of focus background detail, which went unnoticed at full aperture, becomes more defined on stopping down



Clearly the wrong type of subject to attempt with a telephoto view when only a wide aperture can be used

Assignment

Portuguese village

An afternoon was enough for photojournalist Homer Sykes to capture the atmosphere of a Portuguese fishing village. The pictures show a professional approach to taking better 'holiday snaps'

All photographs by Homer Sykes

A small fishing village presents the kind of photographic situation everyone is likely to encounter at some time, probably on holiday. While one village might outwardly appear to be very much like another, there are always many subtle points of interest which give each its own character and individuality. But it is up to the photographer to pick out what gives a place its character, and to render this convincingly in photographs. A little extra time and effort spent on thinking about this can be very rewarding, and can mean the difference between humdrum holiday snaps and interesting photographs.

While on holiday in the Algarve, Homer Sykes discovered the virtually unspoilt fishing village of Alvor. In his approach to picturing the village, Homer

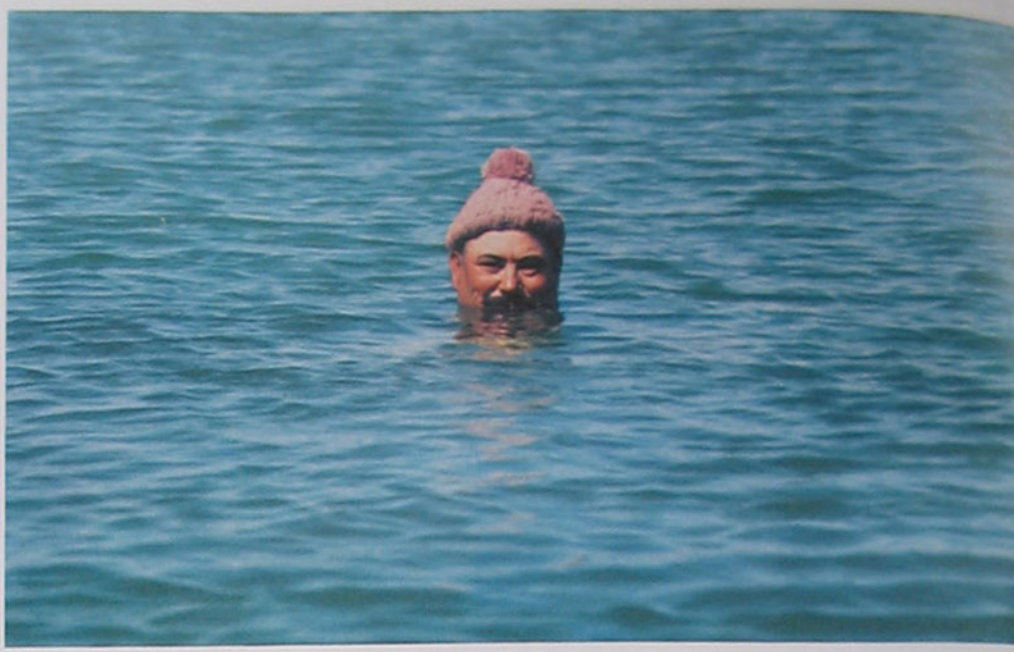
Painted cottage *Homer was fascinated by the bright colours of the house. Here, the combination of colours and the symmetry of the house have produced a striking composition. The presence of the villager completed the scene.*

Village view *To set the scene, Homer shot this panoramic view of the whole village lit by the afternoon sun, using a 28 mm lens. With its strong contrast of light and shade, this shot shows up the shapes of the flat-roofed houses*

tried to take the photographs which best rendered the atmosphere of tranquility and seclusion he found there. As well as this, he wanted to capture the calm, unhurried way of life of the village people. Rather than try to take an overall 'documentary' approach, showing every aspect of the village, Homer decided to concentrate on a few significant details, and present these as simple, but striking images.

The first thing which attracted Homer was the range of colours—brightly painted houses, boats, the intense hues of the sea and the sky. He tried to capture these by concentrating on subjects where colour was the primary feature and provided interest in itself, independently of the subject matter. On the whole, he kept his images simple, sometimes photographing only the part of the subject which showed the most interesting combination of shapes.

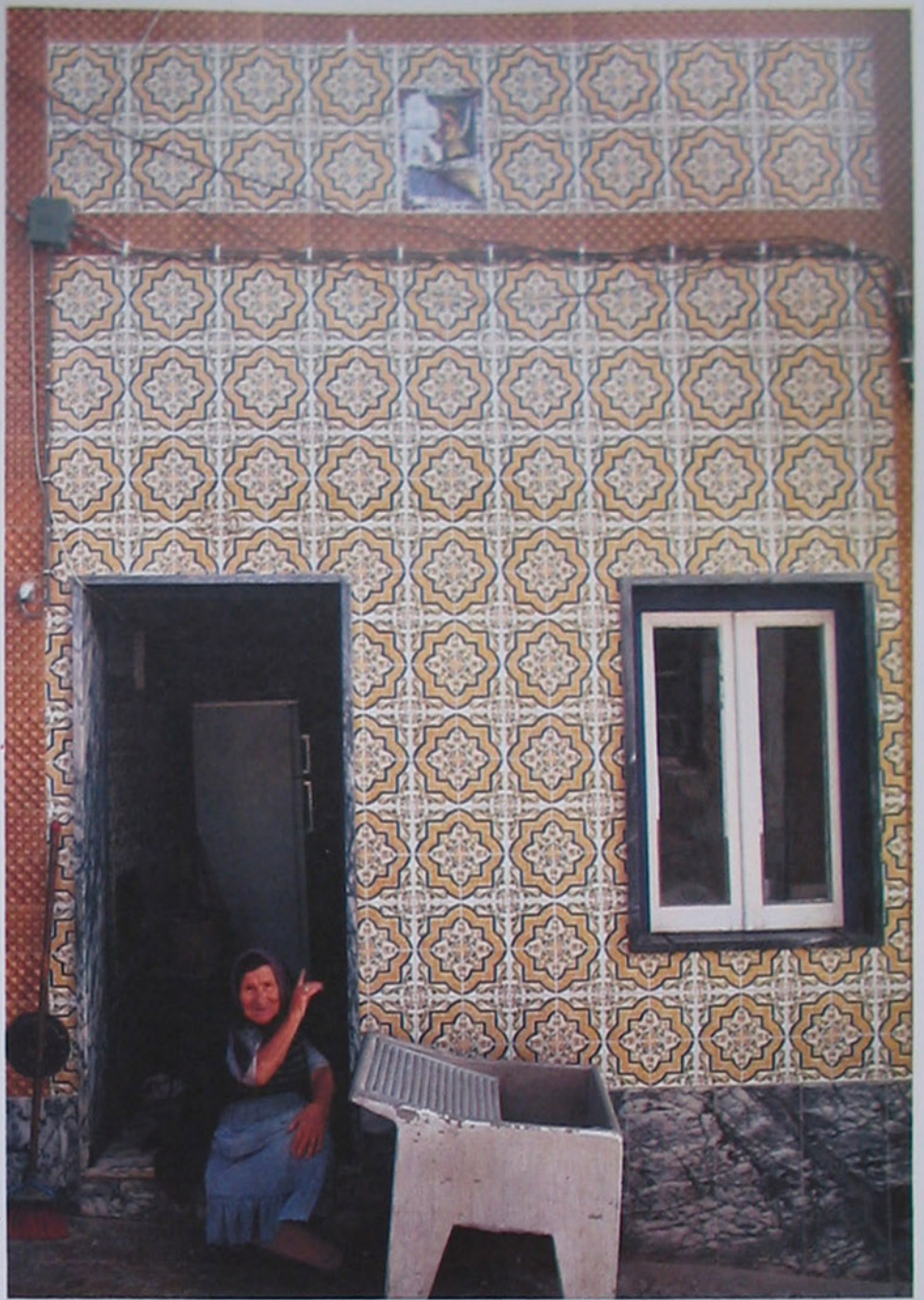
Another aspect Homer concentrated



Street scene *Always on the look out for the incongruous or amusing, Homer found this woman sweeping the street. Her tidy spirit contrasts with the dilapidated buildings. The dog, sleeping in the shade, provides another amusing touch. Here, Homer used a 28 mm lens to bring together all the contrasting elements.* **Regulars** *Before trying to photograph these old men, Homer shared a bottle of wine with them —after which they were very happy to be photographed. A 28 mm lens was ideal for framing them in the confined space of the bar, also giving enough depth of field for the man in the background to appear sharp.* **Painted prow** *It is always a good idea to include elements relevant to the way of life of a place, especially if they are colourful. Homer was initially attracted by the colours of this boat, and then realized that by including just a part of it he could make it into a simple semi-abstract*

Eccentric bather ? *This man was not actually swimming at all, but fishing for shellfish—crouching in the shallow water, he was dragging a basket through the mud at the bottom. Intrigued by this strange spectacle, Homer used a 180 mm lens to bring him closer, still leaving enough water in the picture for the head to look conspicuous and isolated. It is important to be ready for unusual shots like this—if it were not for the hat he is wearing, this man would not be quite so interesting.*

Pious peasant *Some of the cottages had interesting tiled fronts, with very unusual designs. Homer was intrigued by the discrepancy between the richness of the tiled front and the obvious poverty of the inhabitants. The old woman, however, evidently thinks otherwise—for her, the most important feature is the holy image. This shot combines humour with local colour—notice the scrubbing board by the door*



Homer Sykes

on was the villagers themselves—although he did not speak their language, he still established contact with them by being friendly and outgoing. Having them overcome their shyness of the camera, he was able to come up with some interesting 'local colour' shots of people.

Homer wanted to remain fairly inconspicuous, so he took just one Nikon body and a reasonable selection of lenses—a 28 mm, a 35 mm, a 105 mm and a 180 mm. He found this range covered his needs quite adequately, without being too cumbersome. Since he was shooting primarily colour subjects, he used Ektachrome throughout—but always kept an 81A filter on the lens.

Using just one camera is risky—and unknown to Homer at the time, the meter had developed a fault. As a result many shots were overexposed, but it is a mark of Homer's skill that the ones which were properly exposed still gave a strong impression of the village.

Improve your technique

A cold snap

Photography in very cold climates or on high mountains has a special appeal and, properly done, can yield spectacular results. But there are problems which can catch you out if you are unprepared

Cold weather can transform a landscape in a matter of hours. A heavy fall of snow puts its stamp of uniformity on to everything, conveniently concealing all the ugly details that photographers try to exclude from their pictures.

Really cold weather, however, brings with it a host of problems that make photography more difficult. For example, certain types of battery become rapidly exhausted at temperatures below zero centigrade, and at 20 degrees below, your face can easily freeze to exposed metal parts of your camera.

While photographers who live in very cold climates are accustomed to such conditions, anyone used to more temperate weather can get caught out. An event such as a skiing holiday in the mountains can mean taking pictures in daytime temperatures of —20°C or even colder. And the dry but very cold conditions which prevail at high altitudes often seem less cold than near-freezing temperatures nearer sea level, which can mislead the photographer who is unaware of how cold it really is.

Be prepared

Before setting off to take photographs in very cold conditions, you should spend some time preparing your equipment, and your own clothing. Ironically, in cold climates, it is usually the photographer who feels the effects of the cold before the camera, but careful attention to detail ensures that you are able to cope with any problems as they crop up.

In terms of equipment the precautions that you should take depend on the

apparatus you are using, and how cold the weather is. Almost any camera can be operated normally at five degrees below freezing, but at temperatures lower than this, difficulties may start to occur. Even in the relatively moderate climates found at popular ski resorts, you may find that your camera does not function as well as it does in warmer regions.

Why does a camera function less efficiently in the cold ? The most common reason is loss of battery power. Any camera that has a TTL light meter needs a battery to power it, and a high percentage of new cameras also rely on electricity for the operation of shutters and other systems.

Batteries of every type work by chemical reactions, which always proceed more slowly at low temperatures, so the output of a cell is always lowered as the temperature falls.

The way in which low temperatures affect battery 'powered' cameras depends on the exact model and make of cell, and the function which it performs. For example, if the same cell is used to power both the shutter and meter of a camera, at low temperatures it may produce enough current to operate the meter normally, but be too weak to fire the shutter. A further factor is the size of the cell, and its location in the camera body. A tiny button cell fixed into the metal baseplate of a camera body cools down more quickly than a fat alkaline cell buried in the interior of the camera.

Camera manufacturers are often optimistic about the cold weather performance of their products, and if you expect to do a great deal of work in cold climates, you should buy a mechanical camera, or one that has a wide range of mechanical speeds. If you already own an electronic camera, take along several spare batteries for it, and keep one in your pocket until you actually start taking pictures. Only leave it in the battery compartment as long as you are shooting, and as soon as you finish a series of pictures, put it back in your pocket to keep warm.

Some of the more recent electronic cameras can be fitted with a separate pocket-pack of batteries, connected to the camera by an extension cable. Primarily intended for use with a motor drive, these external power packs eliminate this constant routine of removal and replacement of cells.

Warm pockets can also be used as a safe refuge for battery powered exposure meters, though selenium meters need no batteries and in combination with a mechanical camera they can make a photographer completely independent of erratic battery power.

Other sources of camera problems are less obvious. Conventional lubricants become thicker and more viscous in cold weather. This means, for example, that the focusing rings on older lenses can become more difficult to turn, and the general operation of some cameras is more sluggish. The traditional solution to this problem is to *winterize* the camera: strip it down, degrease all lubricated parts, and then use a lighter oil which is less viscous at low temperatures. Thanks to modern lubricants which remain liquid even at very low temperatures, however, winterization is no longer necessary, and the controls on newer cameras should operate as smoothly in the arctic as they do in more temperate climates. Nonetheless, modern cameras still occasionally jam, simply because even solid metal is affected by the cold.

Plastic, too, behaves differently when it becomes very cold. Some types of plastic become quite brittle, and camera neckstraps made of plastic can be snapped in your hand if they are cold enough. Fit leather or woven nylon straps to all your equipment.

There are a few other simple precautions which you can take before going on a cold-weather photographic trip. Your skin can freeze to exposed metal in severe conditions and even if the temperature is as 'warm' as —5°C, bare metal pressed against your face feels uncomfortable. Many cameras have exposed metal on the back, and this should be covered up with adhesive fabric tape or, better still, small patches of chamois leather. A large rubber eyecup can also help to prevent skin damage.

Wearing the right clothes in a cold climate can sometimes make the difference between life and death, but for the photographer there is a special con-

John Sims

Mountain landscape *Large white areas may fool TTL meters into underexposing. If in doubt, take a second shot, giving an extra half stop exposure*

Insulation *In low temperature conditions, your skin can freeze to the exposed metal parts of the camera. Avoid this by covering the metal with tape or chamois leather*

Roger Payling

A battery pack *to fit in your pocket, and connected to the camera by a lead, saves you having to remove the camera's battery to keep it warm*

Keeping warm *It is especially important to keep your hands warm. Moisture in the breath forms ice immediately*

Conifers *Shadow areas can appear bluer on film than they do to the eye, though this effect can often be attractive*

sideration: your clothing must allow easy access to cameras and lenses. This mainly affects your hands and the best solution is to wear two pairs of gloves—a heavy outer pair, and a thin silk inner pair. The silk gloves permit you to adjust the controls on the camera without running the risk of frostbite, so you can safely remove the heavy gloves which otherwise prevent you from feeling the controls.

Out in the cold

In very cold conditions, photographers face a variety of problems. Some of them are familiar, such as the difficulties of measuring the correct exposure when there is snow on the ground, but the physical problems of taking pictures at very low temperatures are less familiar to most of us.

Just as plastic camera straps become brittle in the cold, film also becomes hard and fragile if it is cold enough, and the edge of a strip of 35 mm film can become sharp enough to cut your skin. If you are taking pictures at —10°C or below, take care when you handle the film and wind it gently over the pressure plate. Do not snatch at the lever wind, or you run the risk of snapping the film. Roll film is less fragile than 35 mm in this respect.

The problem of film breakage is aggravated by a motor drive, so try and avoid using one if you possibly can. If you run into persistent film breakage problems, one solution is to keep your camera warm by tucking it into your coat, brining it out only to make the actual exposure.

Cold weather produces extremely dry air, and water vapour is instantly frozen. This can generate problems for the photographer, because in dry conditions discharges of static electricity become more common. Rarely seen in normal photography, these leave lightning shaped marks on the film if it is transported too quickly through the camera. Always rewind film into the cassette quite slowly and again, avoid using a motor drive if possible.

Changing film becomes a chore when the temperature is really low, not just because of film breakage and static problems, but because your breath can form a layer of ice in the film gate if you are not careful.

It is important to control your breathing whenever the camera back is open, and whenever a lens is removed—ice on the reflex mirror can make a camera unusable until it is taken indoors once more. Zoom lenses make this less of a problem because they reduce lens changing to a minimum.

Even when you are taking pictures, with the camera back closed and the lens in place, breath control is important. Clouds of water vapour can drift between the camera lens and the subject, causing a soft focus effect. This is fine for romantic portraits in the snow, but not so good if your subject is a crisp icy landscape. Always hold your breath for a couple of seconds before pressing the shutter release. Also take care that you do not breathe on the front of the lens, or on the viewfinder eyepiece—ice on these surfaces can bring a picture session to a premature end.

Photographic problems

Besides the physical problems of working at low temperatures, there are specific photographic problems. Snow covered scenery is very different from the average scene on which built-in meters work best, and if you use your TTL meter in the normal way your pictures will frequently be underexposed. If you have a separate, hand-held meter, use this to determine the correct exposure by the incident light method explained on page 365.

Reflected light meters, including TTL types, must be used with care and intelligence when there is snow on the ground. It is no use just pointing your camera at distant figures in a snow covered landscape and hoping that the meter will indicate the correct exposure, because the large expanse of white will mislead it. This problem is best thought of as a form of back lighting, and should be dealt with in the same way (see pages 32 to 36). If you have an automatic camera, set it to manual for pictures that include large expanses of snow.

Because of the reflective qualities of snow and ice, the colour temperature of daylight becomes very critical, and you should pay particular attention to using the correct filtration over the lens. White areas in a picture pick up colour casts very easily, and in very cloudy weather you may find that all the snow and ice takes on a blue colour. This can be avoided by using a Wratten 81 series filter. Certain brands of film—notably the Ektachrome family—have a tendency to give a cool rendering, and some photographers prefer to use an 81A filter at all times, to warm up the pictures. This has the added advantage that it cuts down the ultraviolet radiation which is strongly reflected by the snow surface, and can itself cause a pale blue colour cast on the film. More information on colour temperature appears on pages 220 and 221.

The shadows of a sunlit snowscene are illuminated only by the blue of the sky, and they usually reflect this colour quite strongly. Provided that the highlights of the picture, lit by both sky and sun, look natural, these blue shadows should not look objectionable. They may, however, appear excessively dark in some photographs, and you may want to spill some extra light back into them using a card or foil reflector. Fill-in flash usually spoils the atmosphere of snow-scenes, and at low temperatures, the attendant battery problems may make it impractical.

Coming back indoors

When you come in out of the cold after taking photographs, pay special attention to your camera. Water vapour in a heated room quickly condenses on cold metal and glass surfaces and until your camera warms up it will be covered in water droplets. If you only plan to come in for a short time, try and leave your equipment outside, or this layer of water will freeze when you step outdoors again.

Condensation on the camera exterior should do no permanent damage unless it is very heavy. At the end of a day's shooting, wipe the moisture off as it forms, and never open a camera back or remove the lens until everything has warmed up, because condensation on the inside of a camera body is much more of a problem than on the outside. For the same reason, you should keep lens caps on until the lens, too, is warm and dry.

Polar waste *Black and white is very suitable for cold weather photography, where different tones are important*

Bryan & Cherry Alexander

John Sims

Bryan & Cherry Alexander

Bas relief

A simple way to enliven an image and give it a feeling of depth, the bas relief requres little in the way of materials. The same principles work in both b & w and colour for all types of original

In sculpture, the term *bas relief* refers to a particular type of carving. A figure is cut out of a flat surface so that its form stands slightly proud of the surrounding area. Many decorative plaques seen on buildings are examples of bas relief.

In photography, the term is applied to a simple process that can make almost any negative produce a print that looks as if it is a picture of a carved bas relief. The bas relief effect is achieved with combinations of negative and positive films, and can be extended to produce a range of more advanced effects. High key bas reliefs can be made with lith film, or films and prints can be combined using both colour and black and white materials. It is even possible to make a physical rather than a visual relief effect using the swelled gelatin method, where the image actually stands up from the base of the print.

How bas relief works

When you make a print from a black and white negative, the tones of the negative are reversed on the printing paper. If you were to sandwich a negative with a positive duplicate the two images would in many cases exactly balance each other out. A print would reveal nothing but a flat grey tone.

But displacing one of the images slightly so that the positive and negative are no longer in register gives a different effect. Areas of even tone remain virtually unaffected but, at the edges of details in the original image, less dense parts of the negative overlap with less dense parts of the positive. In other places, denser parts of the negative overlap with denser parts of the positive. The overall effect is that all the light in the image overlaps on one side of any detail and all the shadow overlaps or merges on the opposite side. This effect is similar to the sculpting of a subject that is produced by low-angle sidelighting and gives a print the appearance of being raised up from the print paper.

Making a bas-relief print is straightforward. Choose a negative—ideally one with fairly low contrast and not too much fine detail. Too much texture in a bas relief print tends to look furry rather than sculptural. All details in the original negative are emphasized in the relief print, but as this includes scratches and dust marks you must be scrupulously clean when you work. Contact print the negative on to a continuous tone black and white film such as Plus-X or FP4 to make a film positive. The positive should also be of low contrast, so you may find it better to work with a blue sensitive continuous tone process film, such as Kodak's Gravure Positive. Another advantage of Gravure Positive is that it allows you to work by red safelight instead of in total darkness. To make the contact print on to film, use the same system as for normal paper contact prints. The film is generally faster than photographic paper, so the exposure times are shorter.

Plates and shadows *A subtle bas relief —evident from the shadows—is achieved simply by combining the original slide with a very soft negative image bound slightly out of register*

John Ward

Bas relief using lith *By printing on to colour paper using a combination of negative and positive lith images (top) any colour can be selected for the 'relief' area (centre). A further variation is to combine exposures from lith and tone negatives, each through a different colour (bottom)*

Tim Stephens

When working with small film sizes such as single frames of 35 mm film it is impossible to make an exposure test strip. So in order to judge the exposure, select a strip of negatives of similar density and contact print them on to a similar length of unexposed film, making your test strip down the length of the film. Process the length of film in a small dish rather than a film tank. If you use blue sensitive film you can develop by inspection under safelighting and remove the film from the developer when it looks correctly developed. It is better to underdevelop slightly, so that the positive is full of mid tones, but flat.

Once the positive is dry, tape it to the original negative very slightly out of register. A small displacement is magnified considerably when you make the enlargement. Hold the negative and positive up to an evenly lit surface when you tape them together so that you can easily see what you are doing. There are many different displacements you can select, but if your aim is to accentuate the relief of an object such as an old coin, then the result should reinforce the original direction of the light on the object. If the print does not turn out the way you want it to, then it is a simple matter to reregister the positive and negative and try again.

When you make the print you should use a glass negative carrier to keep the film sandwich flat. Make the enlargement just as if you were making a normal black and white print. The main areas of the subject should print as a flat, mid tone grey. The outlines or contours of the image should print as either hard black or clean white lines. If the films are displaced too far relative to each other, a distinct double image can result.

If you want to achieve a higher quality result, try working with larger film formats. This helps with registration and you have much finer control over the degree of relief. Quality is also improved because there is less visual interference between the grains of the film and the bas relief image. You should work with orthochromatic Gravure Positive film so that you can see what you are doing during development.

Set up your enlarger as for normal black and white printing, focusing the image of your negative on to the easel. Under a red safelight, cut a strip of film and make an exposure test. Develop the film in normal print developer in a dish. After fixing, washing and drying, examine the test strip and set the enlarger to what you consider to be a suitable exposure. Expose a whole sheet of film the same size as your intended final print size. At this stage you can dodge and burn areas as you would for a normal print. When this large sheet film positive is processed and dried, you can use it to make a contact print on a second sheet of the same film. Both pieces should be kept flat during exposure with a clean sheet of glass.

When both sheets are processed and dry, trim one slightly smaller than the other. Lay the smaller sheet over the larger and align the two for a suitable effect, as you would for a small bas relief positive and negative. This is easier if you have a professional lightbox to work on, but as long as the two sheets of film are adequately lit from behind you should be able to find a suitable alignment. Try various degrees and angles of displacement until you are pleased with the bas relief effect. Bear in mind that the tones of the image reverse when you make the print. Tape the two films together when they are properly positioned, and contact print the combination on to a sheet of paper, using a sheet of glass to keep everything flat and in contact.

The resulting print should show better quality than that made by the small format method—there should be more distinct areas of tone and black and white.

John Ward

Leaves in relief *A low density, very soft negative on lith film developed in ordinary developer was bound slightly out of register with the original slide. Such a combination can be arranged and copied several times until you have a number of bas relief variations.*

Floral patterns *The bas relief technique can lend an image a very graphic, even abstract nature*

Colour bas relief

Instead of making black and white bas relief prints, you can use colour paper and filters to make prints from black and white negatives. You can either make a simple colour print, setting the enlarger to a particular filtration which results in a print that looks as if it could also have been produced by toning techinques, or you can give two exposures, and hence create two colours.

Set up your enlarger filtration so that it prints a neutral grey on colour paper when there is no negative in the carrier. Each batch of colour paper needs checking for exposure and colour balance. Place a sheet of negative–positive colour paper under the bas relief film combination, and give a short exposure so that the clear areas of the sandwich just print as black. Add more filtration to the enlarger, either with printing fiters or by dialling in dichroic filtration, so that the next exposure prints as a bright yellow (see page 859). When this second exposure on the sheet of paper is made the depth of the yellow tone on the print is determined by the density of the bas relief sandwich. The processed print has clear white lines, areas of texturless yellow, and hard black lines.

Lith bas relief

If you work with lith film rather than continuous tone film, the steps are the same in principle as those already explained. However, red safelighting and two part lith developers are essential. Instead of subtle tonal ranges, you end up with dramatic line results in black and white only. You can also print lith film bas relief sandwiches on Cibachrome paper using blue, green and red additive filters to make extremely bright colour bas reliefs. For example, lay the sandwich over a strip of Cibachrome material, and set the enlarger to print with white light. Expose through a red primary filter to produce a test strip with 5, 10, 20 and 40 second exposures.

On the basis of this test you should be able to select a suitable exposure to print through the clear areas of a bas relief lith sandwich as bright red.

Yet further effects are produced by combining films with prints. Make a continuous tone positive film enlargement from a negative using the techniques described above. Then contact print this on negative to positive colour paper with suitable filtration to give a bright colour. When the print has been processed, you can overlap the film

Peter Pocock at John Knill Studios

positive slightly out of register to give a bas relief effect. The result is a very subtle bas relief in colour and grey, the grey tones giving an illusion of colour solarization. You can preserve the effect either by rephotographing the result on to colour slide film, or by framing the combination of film and print for display.

Physical bas relief

Using photographic principles and the unusual physical properties of gelatin, you can actually form an image of a bas relief in physical relief. Unfortunately the final image has to be small (about 7.5 cm square), as the three-dimensional effect is not very marked.

The process calls for a negative of a suitable subject, such as a coin or a profile portrait. Light the subject so that it appears in strong relief. Photograph it and enlarge the resulting negative on to film. Contact this positive on to another piece of film to make an enlarged continuous tone negative.

For the next step, soak 50 g of ordinary gelatin in 175 ml of water for about four hours, then heat the resulting mixture gently in a water bath until the gelatin is dissolved. Add about 6 ml of glycerin, then strain the solution on to a small sheet of glass while it is still warm.

When the plate has dried it can be sensitized to light by soaking it for five minutes in a solution of 6 g ammonium bichromate dissolved in 100 ml of water. Once sensitized the plate should be dried in darkness.

Contact print the large negative on to the sensitized plate. Since the plate has very low sensitivity, you must make the exposure by sunlight. The gelatin under the clear areas of the negative is hardened by exposure, but the areas under the dense highlight tones of the negative are unaffected. This unaffected gelatin swells when soaked in water, so once you have made your exposure you must soak the plate in water to 'develop' it. This makes the highlights stand out in relief. It is even possible to make a plaster cast of the image so that you can make further relief copies.

Subject choice *A very subtle bas relief (below) can be almost indistinguishable from the original (left). A stronger bas relief image would have muted these colours unacceptably, while no improvement could be made by altering the extent or direction of the registration*

John Ward

SEAPHOT underwater agency

This unique British picture agency specializes in underwater natural history and handles the work of photographers working in the greatest depths and farthest corners of the globe

If you want an underwater photograph taken on the sea bed, or a shot from a surfboard, the people to contact are *Seaphot*. This agency, based in Bristol, England, has probably the largest specialist library of underwater photographs in the world.

Its material ranges from the commonplace to the absolutely unusual and obscure. The collection includes, for example, some of the only underwater photographs in existence of a living coelacanth, a 1½ metre free swimming 'living fossil'. Until a dead sample was trawled up by fishermen off the islands of the Comoros in the Indian Ocean in 1938, the coelacanth was known only from fossil evidence and was believed to have been extinct for millions of years.

In 1978 a BBC television team, which included Seaphot photographer Peter Scoones, set out to make a film about coelacanths. They struck a number of problems: they were unable to locate any of the creatures and they also lost their special video camera in an underwater cave. The rest of the team eventually returned to Britain, but Scoones decided to stay. His persistence paid off.

Unexpected volcanic eruptions provided him with a wealth of other unusual subjects so that one night he had been taking pictures until the small hours when he staggered exhausted to bed. Shortly afterwards he was woken with the news that a living coelacanth had just been caught by local fishermen. He persuaded them to release it and under extremely difficult circumstances took the unique photographs which now form a valuable, and probably irreplaceable, part of the huge Seaphot library. His movie sequences were used in the BBC natural history series *Life on Earth*.

Waiting for food *To get at the more vulnerable underside of the sea urchin the trigger fish tries to blow it over—thus stirring up tiny crustaceans for the waiting butterfly fish to eat*

Coelacanth *A unique picture of this rare fish and a valuable record of its shape, colour and patterning*

Peter Scoones/Seaphot/Planet Earth Pictures

The Seaphot library, also known as Planet Earth Pictures—includes the work of some 178 photographers spread all over the globe, from South East Asia and Antarctica, to the Mediterranean and the Americas. Their work covers underwater natural history, marine technology, commercial and sport diving, and also includes such surface marine subjects as seascapes, tropical beaches, oil production platforms and all water sports. Their most recent development has been the inclusion of land and air-based natural history.

The agency started in 1969 when underwater biologists John and Gillian Lythgoe wrote their first book, *Fishes of the Sea*, and wanted illustrations for it. Although they both took photographs themselves, it became quite clear that there was no reliable central source in Britain for photographs of marine life. At the same time, the British Society of Underwater Photographers (fondly named B-soup) was just getting started with a membership of 10. They were inexperienced at selling their work commercially and realized that they were being exploited by publishers. They were being paid widely differing fees and their pictures were routinely being lost. The Lythgoes, who had the necessary biological and technical knowledge, suggested setting up an independent agency to coordinate their work. Gillian was able to work from home and organized the material in to a comprehensive library. From these beginnings grew an agency of which, according to Gillian, 'it is probably safe to say that we can either do ourselves, or know photographers who can do, anything that is required underwater or on the sea itself.'

The photographers handled by Seaphot are usually adventurous people. They run diving schools, or are hang-glider pilots, North Sea divers or journalists. They are often prepared to go off to remote places and undertake assignments which may put them at personal risk. Many are professional scientists and engineers who visit locations more or less closed to the normal traveller, including Antarctic Islands, remote coral atolls and the bottom depths of the ocean floor. These people have an expert scientific knowledge of their subject which informs the kind of pictures they take. But often local knowledge and skills gained from doing a dangerous daily job can be just as important.

Gillian Lythgoe tells the story of one of their photographers, Jesus Perez, who works for the Spanish fishing authorities, helping with the tuna catch. 'The fish are driven into a kind of corral made by a ring of fishing boats with nets stretched between them, which encircle the fish entirely. During this process sharks and swordfish get trapped. Perez's job is to get rid of these before they damage the nets. He used to take his cameras with him into the tuna nets while the fish were still in the nets, to photograph the sharks.

New subjects and new photographers are constantly being added to the Seaphot library. 'In addition to running the library itself we have a large number of photographers coming to us every year to show us their work. We are prepared to look at everyone's portfolio. But photographers have to know what is worth taking. We go for excellence, as that is what maintains our reputation, and we take people on if we think their work is good and saleable', says John.

But though the Lythgoes hold people's pictures in the library, and act as a contact for photographers, they do not actively sell anyone's photographs. 'It is

Peter D. Capen/Seaphot/Planet Earth Pictures

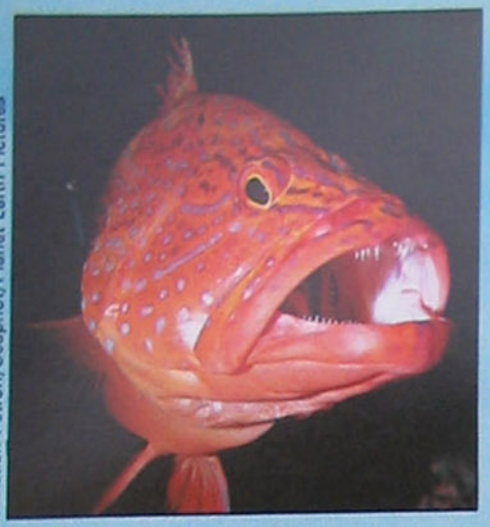
Diver at Truk Lagoon *in the South Pacific. The gauge around herneck indicates the diver's depth and the amount of air left in the tanks*

Walter Deas/Seaphot

Mantis shrimp *Taken near Heron Island on the Great Barrier Reef, Australia. It is about 10 cm long and feeds on small fish*

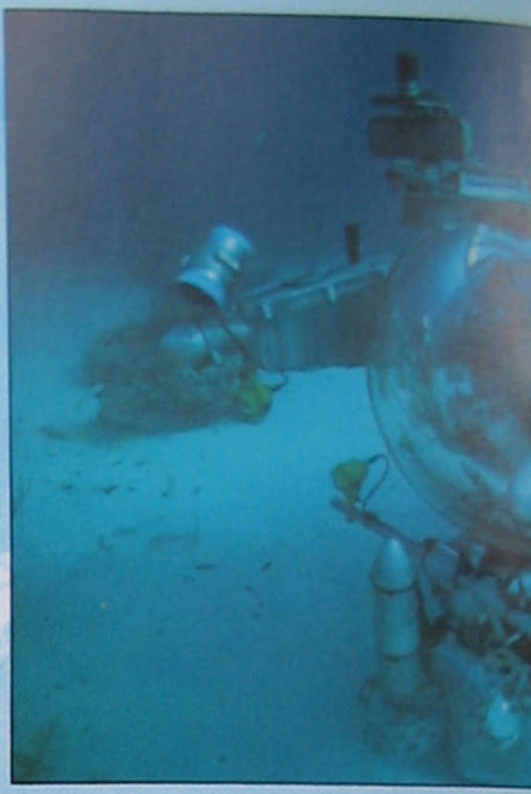
Deep sea crabs *Some of the rare creatures that live in the hydrothermal area of the Galapagos Rift. The temperature probe of the submersible can be seen in this picture which is taken by a special camera*

Robert Hessler/Scripps Institute of Oceanography/Seaphot/Plant Earth Pictures



Christian Petron/Seaphot/Planet Earth Pictures

Indo-Pacific rock cod *By using flash underwater photographers can reveal some of the brilliant colours that are usually obscured in the murky depths*



Underwater photographer *Levers operate the controls on the specially designed housing, which fits most cameras. It also has a lightmeter*

Flip Schulke/Seaphot/Planet Earth Pictures

Submersible at work *These pressurized craft hold two people and are used for both commercial and scientific research on the seabed*

could be better illustrated by another type of picture.' They can then make suggestions and help the client select suitable material. As Gillian pointed out, 'There are various pictures that we are always being asked for, for example animal behaviour such as one animal feeding on another. These are extremely difficult to get as divers simply do not come across them very often. Equally popular and difficult to obtain are pictures of commercially important fish such as cod and herring. Because they live in mid ocean and are extremely nervous of noise you cannot get near them with an aqualung. We often get asked, too, for aggressive shark pictures, coral reef scenes and surface seascapes.'

Because photographs are constantly being sent into them, a large proportion of the Lythgoes' time goes into identification and classification of pictures. Most of the time, they have the facilities and knowledge to do this themselves, but occasionally they need to turn to their colleagues in places like the London Natural History Museum or the Institute of Ocean Sciences for assistance. It is therefore one of the particular strengths of the library that John Lythgoe is a professional academic research scientist and is able to plug directly into that active scientific fraternity. He 'speaks the same language.'

A unique set of pictures has come from the Galapagos Rift, off the coast of the Americas. This consists of 50,000 km of fissures deep under the ocean at 2000 metres, where the earth's molten interior is very near to the surface. As a result the water is superheated locally to several hundred degrees centigrade. In

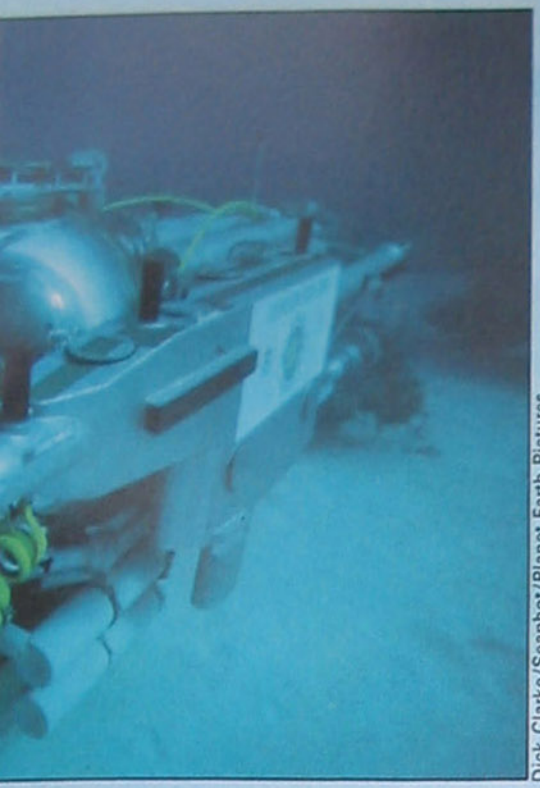
up to photographers to find their own work. We do not take their portfolios round to publishers, but if a client comes to us with a specific request and we haven't got it in our files, we can find someone to do it. In this way a lot of new material keeps flowing into the library.

The Lythgoes see themselves as the 'filter' through which photographic material comes and goes from the library. They feel that running such a library is a creative job as it challenges their knowledge and resources to deal with people who are not scientifically orientated. Although Seaphot has such a solid scientific base, they sell to the mass market, including people who make calenders and brochures, to advertising agencies, publishing houses and general educational publications. They have deliberately kept the word 'science' out of their title because they felt it might narrow their potential range of outlets.

Clients often come with vague requests. The Lythgoes are able to say 'that doesn't actually happen or isn't possible, but what you are looking for

Antarctic *A baleen whale flips its tail up before diving into the depths to feed on krill and small fish*

Photograph Bora Merdsoy



Dick Clarke/Seaphot/Planet Earth Pictures

this unlikely environment several unique forms of life have evolved—giant worms, giant clams and mussels, and white crabs. At these depths sunlight never penetrates—yet they survive by using volcanic heat as a source of energy.

Pictures at that depth can be taken only from a piloted submersible craft which has purpose-made deep water cameras mounted on the outside, controlled by scientists inside. 'We have a very good relationship with the research institute that carried out the survey of the Galapagos Rift and this means that we have access to prime visual research material on this phenomenon', says John.

Underwater photography as a whole is much more difficult and has a higher failure rate than land-based photography because there are many more variables. The most obvious problem is keeping the camera dry. There are a number of purpose-built underwater cameras on the market, but surprisingly, an ordinary camera may be safely taken down to about 60 metres providing it is in a waterproof housing, though this tends to make it bulkier and heavier. This depth is also the limit for an aqualung diver and it is where most underwater pictures are taken because there is more marine life and more light. It is worth noting that between 60 metres and around 200 metres life is sparser and as it is too deep for aqualungs, this area is the preserve of the commercial diver, with special diving gear and special underwater camera equipment. Between 200 metres and the bottom of the ocean floor is the realm of the submersible.

Lack of light is the other element which can cause major problems. Even in the clearest conditions and within aqualung depths there is very little natural light. The farthest one can see is often no more than 30 metres—and that is just to perceive something is there, let alone focus. What little light there is has a very strong colour cast, greeny-brown in temperate coastal or fresh waters and blue in open ocean and tropical waters. Another complicating factor is the sus-

Peter D. Capen/Seaphot/Planet Earth Pictures

Clown fish *Immune to the stings of the sea anemone this tiny fish finds protection living and breeding among them. This was taken near the Caroline Islands in the South Pacific*

Sunset at Truk Lagoon *Good underwater locations can often be excellent land based locations too*

Peter D. Capen/Seaphot/Planet Earth Pictures

The ship's telegraph *A rusting remnant of the Shinkoku Maru—one of the many ships from the Japanese fleet sunk in Truk Lagoon at the end of World War 2*

Peter D. Capen/Seaphot/Planet Earth Pictures

pended material floating in the water. If flash is used, the flash unit must be some distance from the camera in a separate waterproof housing as it is essential to keep unilluminated water between the lens and the subject. If the flash were attached to the camera itself, the light would reflect off particles in the water, rather like the effect you see when driving through falling snow with the headlights full on.

At the same time it is also important for the photographer to get as close as possible to the subject as it is difficult to combine closeness with a feeling of breadth, a wide angle lens is therefore nearly always used. Fortunately, as there are very few rectilinear features underwater, distortion is not as obvious as it is on land.

Seaphot and its photographers have been major contributors to advances in underwater optics. As they have been in the vanguard of underwater photography, they have had to solve the problems of underwater vision themselves and to design and make equipment that would enable them to take good high resolution photographs under extremely difficult circumstances.

Flip Shulke, an American photojournalist and one of Seaphot's most experienced photographers, has himself designed and marketed what is still one of the world's best-selling underwater housings for a camera. His speciality is photographing people in the sea and he has chalked up a number of firsts, one of them being underwater fashion photography. 'There were all sorts of problems involved in this assignment, let alone one of optics. He had to take people who were primarily models and certainly not experienced divers or swimmers. They were held down with lead weights around their ankles and couldn't wear an air supply as they were modelling evening dresses and it would have spoiled the effect. When they needed to take a breath, they had to beckon in someone who had a mouthpiece with an air supply. Yet they managed to look natural!'

Other kinds of problems exist in underwater photography, notably sharks. But even these are not necessarily dangerous. 'They are troublesome and a nuisance and you have to keep an eye out for them. The only time when they are really dangerous is when there is blood in the water. At other times they can just be a disruption.'

After its earlier exclusive concentration on underwater work, Seaphot has now moved into land-based natural history. 'We feel that if publishers are doing a natural history book, it is easier for them to go to one library for everything rather than get pictures of wildlife from one library and underwater material from another. Our underwater library is totally comprehensive now and our land-based material is rapidly catching up.'

As part of their land-based work, the Lythgoes acted as consultants in Kenya for a sequel to *Life on Earth*. They used hang gliders with cameras bolted to the frame to film birds, in particular vultures, using the naturally occurring air currents. (Hang gliders are the nearest thing to bird flight that man has invented.) 'Birds of prey are particularly territorial about the thermals and they can get very angry at an alien presence. We flew among the vultures, sometimes as high as 1000 metres above take-off level. Fortunately, they were more curious than aggressive and flew along behind, looking at us. It was still a trifle unnerving,' said John. It was during the same East African trip, that one of the other Seaphot photographers, Keith Scholey, was able to take some pictures of the rarely recorded river crossings during the migration of the wildebeest population in the Masai, Mara and Serengeti game-reserves.

About two million in number, the wildebeest cover enormous areas of land looking for fresh grazing. When they

Flip Schulke/Seaphot/Planet Earth Pictures

Bathing beauty *Flip Shulke set a trend for underwater fashion shots in 1972 when he took these unusual pictures for the London 'Daily Telegraph'*

come to a river they have by instinct to cross it but are not strong swimmers. They spend days working up the courage to do so and only when numbers have built up and the back of the herd pushes those at the front into the water do they cross. Many hundreds drown and the rivers are full of their rotting carcasses which are easy prey for the ever-present vultures. The photographs Scholey took were featured in the British *Sunday Times* colour supplement and form an important part of the land-based natural history section of the library.

In addition to all their other activities the Lythgoes have published a number of books and are currently preparing outlines for more. They are gearing themselves to take part in what they see as a growth in natural history publishing. Ideas that were, until recently, the preserve of the specialist or academic are now being enthusiastically received.

As John says, 'there has been a subtle change. It's not now so much about certain individual species, but more about general concepts such as what animals can see and hear or how plants are adapting to changing environments.' This adaptability and readiness to keep up with current trends are what have characterized Seaphot all along.

Mass river crossing *made during the wildebeest's annual migration across East Africa in search of fresh grazing*

Keith Scholey/Seaphot/Planet Earth Pictures

The vultures *always lie in wait at the river crossings—knowing that many of the wildebeest will drown*

Keith Scholey/Seaphot

Flash synchronization

Flash is an extremely useful type of light source. But its very short duration means that the firing of the flash and the operation of the shutter must be properly coordinated

Even the tiniest flash unit can emit enough light to illuminate a subject brilliantly and make it possible to take good pictures in the gloomiest conditions. But it can only give out this bright light for a fraction of a second—the flash may last for as little as 1/30,000 second. For properly exposed pictures, this brief flash must occur at exactly the moment when the shutter is fully open—that is, flash and shutter must be properly synchronized.

Different types of shutter—leaf shutters in lenses (see page 110) and focal plane shutters (see page 84)—require different synchronization methods. So do the different types of flash—bulb and electronic.

Steve Mansfield

Bulb flashgun *Although electronic units are now the most common type of flash, bulb guns are still available*

Leaf shutters

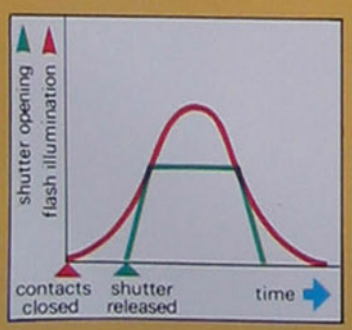
There are usually two synchronization modes for leaf shutters: M and X. These give the appropriate synchronization for bulb and electronic flash.

The M setting is for bulbs only. When the switch on the lens is put to the M setting, the contacts connected to the shutter close as the shutter release is pressed and trigger the flash immediately. But with bulbs there is a delay between the closing of the contacts and the flash reaching its maximum intensity. With 'M class' bulbs—M stands for medium delay—the delay is approximately 23 milliseconds. However, if the opening of the shutter is delayed very slightly—after the shutter release is pressed—the flash has time to reach the necessary intensity. When an M class bulb is used with a shutter set at a fast speed—say 1/125 second or faster—the flash circuit must be closed about 16 milliseconds before the shutter blades start to open. If not, the flash will be brightest after the shutter has closed, resulting in underexposure.

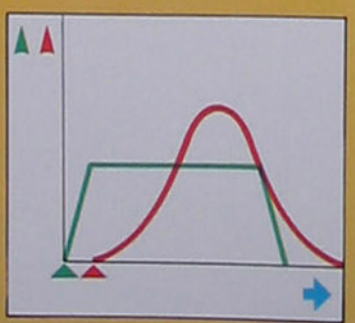
M synchronization is often achieved by using a mechanical or electronic system to delay the opening of the shutter, though the delay is so short that it is impossible to detect. In this way, bulbs can be used with the M setting at shutter speeds of up to 1/500 second.

When the X setting—short for xenon, the inert gas with which flashtubes are filled—is used, the flash contacts close at the instant the shutter blades reach the fully open position. In this case, then, it is the firing of the flash which is delayed. This means that bulbs can only be used with slow shutter speeds—1/30 second and longer—when the flash has

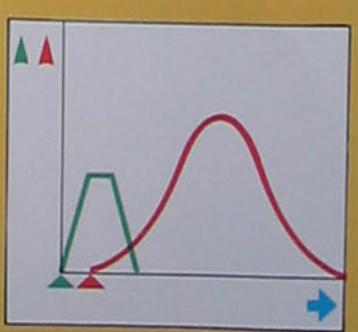
Synchronization with M class bulbs



Correct exposure *Using M synchronization the flash is fired before the shutter*

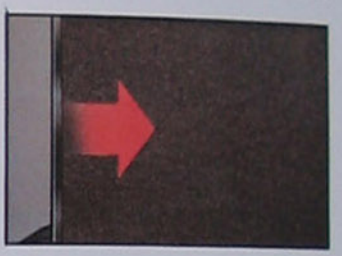


Correct exposure *can also be achieved using X sync and a slow shutter speed*



Underexposure *This results from using a fast shutter speed and X sync*

Synchronization with focal plane shutters



Correct shutter speeds *The flash fires when the shutter is fully open*

time to reach full intensity during the exposure.

The X setting is really designed for electronic flash which reaches its maximum intensity in a very short time. For all practical purposes it can be regarded as occurring instantly with no delay at all. Electronic flash can be used at all speeds of a lens shutter, and because of the short duration of electronic flashes —rarely longer than 1/1000 second—the whole of the flash is made use of with no wasted light. Electronic flash can never be used at the M setting as the flash will finish before the shutter opens.

Focal plane shutters

From the point of view of flash synchronization, a focal plane shutter is less satisfactory than a lens shutter. As with lens shutters, some cameras with focal plane shutters have M and X synchronization. But most have X and FP settings, the latter being for special bulbs.

Most focal plane shutters work by using two blinds. One uncovers the film and the other covers it again. At fast shutter speeds the effect is that of a slit moving across the film. This means that, although each part of the film is exposed to light for only, say, 1/500 second, the entire operation actually takes longer. The result is that with speeds faster than around 1/60 second with most shutters—or 1/125 with vertically run shutters on some 35 mm cameras—there is no time when the film gate is totally uncovered.

For this reason electronic flash, used with X synchronization, can only be employed at these relatively slow shutter speeds. The use of faster speeds results in the flash firing when the second blind has already started to cover the film. The effect is partial exposure, and the faster the shutter speed, the less the area exposed. Slower speeds give *open blind* exposures—the whole of the film gate is uncovered by the first blind, the flash fires, and then the second blind closes the shutter.

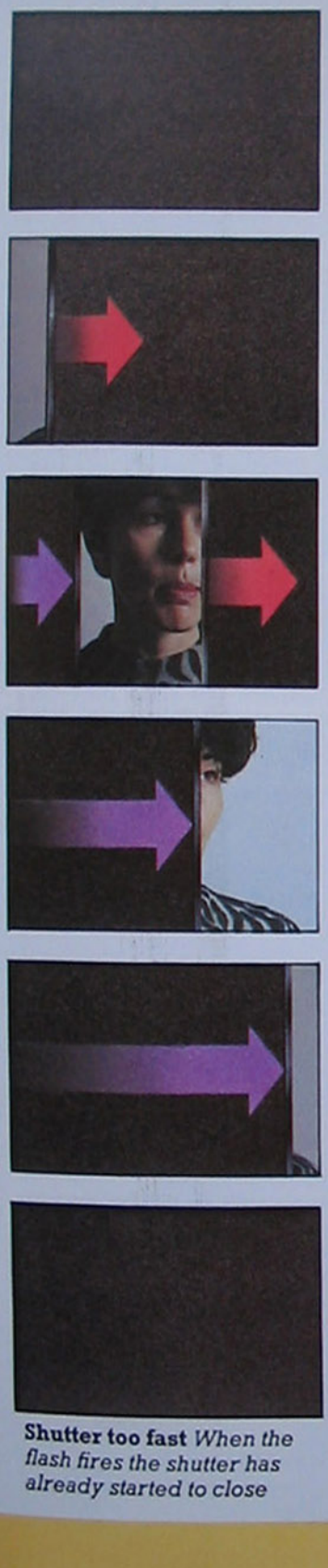
The fact that fast speeds cannot be used may cause problems if you want to use fill-in flash when the available light is fairly bright (see page 628). One solution is to use the alternative FP synchronization setting available with most focal plane shutters, together with special FP (focal plane) bulbs.

These bulbs are designed to burn slowly, so giving out a consistent amount of light over the period of time it takes a focal plane shutter to operate—thereby acting in a similar way to available light. Normal bulbs can be used with focal plane shutters, with the X synchronization setting. But as with lens shutters, slow shutter speeds (1/30 second or longer) are essential to avoid partial exposure.

The exact synchronization speeds of different shutters—even those of the same basic type—can vary according to the design of the camera. For example, 35 mm cameras with horizontally run focal plane shutters usually have a synchronization speed for electronic flash of 1/60 second. But some models feature a special flash or X setting on the shutter speed dial. This normally gives a shutter speed of 1/80 or 1/90 second. The precise synchronization speeds of a particular camera are usually given in the instructions which come with it, and it is essential to know the speeds for different types of flash if mistakes are to be avoided.

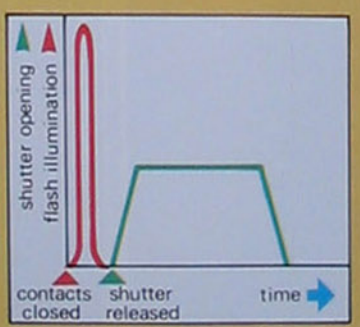
Vautier/de Nanxe

Fill-in flash *When adding flash to daylight, as above, it is important to know how your equipment synchronizes*



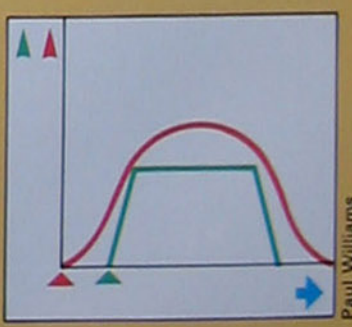
Shutter too fast *When the flash fires the shutter has already started to close*

Synchronization with electronic flash and FP bulbs



Electronic flash *With M sync the flash finishes before the shutter opens*

Correct exposure *With X sync the flash fires when the shutter is fully open*



Paul Williams

FP bulbs *The flash fires before the shutter opens with FP synchronization*

Equipment file

Slide copiers

You can make duplicates of your irreplaceable slides with one of the many different slide copiers available. But the quality of copiers varies according to the type of copier you choose

Dave King/courtesy of Bowens, Nikon, Olympus, Ohnar, Sunagor

Anyone who has lost or damaged a treasured slide should appreciate the value of copies, but there are many different copying methods and it can be difficult to establish what equipment you need.

It is possible to make copy slides without any specialist equipment at all, using a slide projector, but results are generally poor—the copy loses much of the sparkle, colour and sharpness of the original (see page 726). Much better quality copies are possible using an enlarger in the darkroom (see page 1121), but if you do not possess an enlarger, you must buy special slide copying equipment. These range from simple attachments used in conjunction with a 35 mm SLR to expensive bench-top copiers capable of giving results almost as good as the original.

Fixed focus copiers

Inexpensive and easy to use, fixed focus copiers are perhaps the most practical proposition for quick basic copies. Quality is not particularly good but is quite adequate if you only want reference duplicates to get an idea of what the original is like—this saves handling the original unnecessarily.

There are two basic types of fixed focus copier: *auxiliary* slide copiers that are used in combination with the camera and standard lens; and *direct* slide copiers that fit on the camera body in place of the lens.

Auxiliary slide copiers consist of a short tube containing a single close-up lens. The slide is slotted into a mount on the end of the tube and held in position with a spring clip. The mount can be rotated for alignment, but for horizontal/vertical adjustment, the slide may only be moved in one direction.

The copying tube is screwed into the filter thread of the camera's standard lens which must be focused on infinity and set at a fairly small aperture, such as *f*/11, for sharp copies. The copiers are designed to work only with the standard 50 mm lens. A lens with shorter focal length will include the slide mount in the copy: a telephoto lens will cut out some of the picture. You can use a telephoto to crop the picture, but quality is poor.

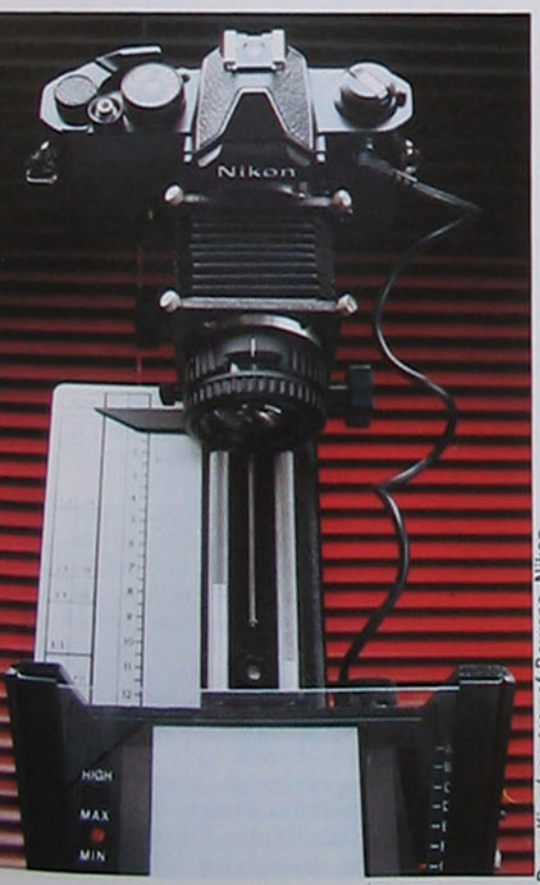
Direct slide copiers are attached direct to the camera body in place of the lens: they have a universal T-2 type mount which allows you to use them on any type of popular SLR. The tube is much longer than the auxiliary but the slide carrier is similar. There are no focus or aperture controls, and the system relies on a very narrow fixed aperture for good depth of field to ensure sharp copies. Unfortunately, the

Slide copiers *range in price and versatility between simple fixed focus and complex bench top types*

Copying lenses *The use of an enlarging lens in conjunction with a bench-top copier*

Auxiliary copiers *This type of copier screws into the filter thread of a standard lens. The slide is held securely in position in the mount by a spring clip, though this allows very little scope for adjusting the position of the slide*

Dave King/courtesy of Sunagor, Olympus



Dave King/courtesy of Bowens, Nikon

narrow aperture means that the image in the viewfinder is very dim.

Both types of copier magnify the original slide slightly. Although this may sometimes crop out valuable detail, it is usually an advantage—even if the slide is not accurately placed in the mount, the edge of the picture will not appear in the duplicate.

To make a copy, the copier and camera must be aimed at a bright, white light. The light is diffused evenly across the slide by a frosted, etched or opal glass or plastic sheet at the back of the copier's slide holder. Daylight or a sheet of white card lit by the sun, are the most suitable light sources but copies can also be made using electronic flash—though exposure calculations can be difficult.

On the auxiliary type copier you can make some adjustments to both aperture and shutter speed in order to produce correct exposure. On the direct type, only the shutter speed may be adjusted.

One of the limitations of both auxiliary and direct fixed focus copiers is the fact that you cannot usually alter the framing to crop out unwanted detail. If you frequently wish to crop slides, you may therefore prefer a fixed focus copier with a zoom facility.

Zoom copiers

Like direct fixed focus copiers, zoom copiers are long tubes which fit into the camera body. A central rotating control sleeve varies the magnification from approximately the same size as the original slide, to three times enlargement for selective cropping. They produce a dim image through the viewfinder as the aperture is permanently fixed at *f*/16.

In common with direct and auxiliary copiers, there is no adjustment for fine focusing. The type of lens system used results in the focus remaining fixed.

Zoom copiers can be adjusted during a copying exposure to make a zoom effect in the copy slide. It is, in fact easier to do this on the zoom copier than on some of the optically better and more expensive bellows and bench copiers. The only problem is that because the image in the viewfinder is so dim, it can be hard to see just when you have achieved the right framing.

With all types of fixed focus copiers, however—zoom, auxiliary or direct—quality is indifferent and if you want duplicates of a high standard you must be prepared to pay for one of the more elaborate, and expensive, bellows or bench-top copying systems.

Dave King/courtesy of Bowens

Bench top copier *On the Bowens Illumitran, the transparency, after having first been removed from its mount, is positioned in a holder over the light source*

Density test *To test the density of the slide, a meter cell is swung into place above it and a reading is indicated on the meter on the front of the unit*

Bellows attachments

One of the best systems for achieving high quality copies is a bellows unit. If you already have a bellows unit for close-up work, you can simply buy a slide copying attachment that fits over the front. Otherwise you will have to buy the bellows as well. While it can, of course, be used for close-up photography as well, a bellows unit can cost as much as a basic SLR. The advantage of bellows copying, though, is that you have full control over framing, variable (and so more accurate) focusing and choice of aperture.

With the cheaper, manual bellows units the slide copying attachment clips on to the rails of the bellows. It consists of a slide holder with an opal light diffuser. A standard 50 mm lens is fitted to the end of the bellows and the space between the slide and the lens can be shielded from extraneous light with an optional linking tube. The lens must have manual aperture control since the lens is not directly linked to the SLR body. Magnification is adjusted by clipping the holder in different positions along the rail and refocusing the lens.

The more expensive bellows units and most automatic bellows accept slide copiers of more rigid design which attach firmly to the end of the bellows rails. The space between the copier and lens is sealed with a bellows tube that screws into the lens front thread.

The copy size can be adjusted by moving the camera and the lens on a separate rack and pinion mechanism, not by changing the position of the slide holder. With automatic bellows, the linkage between the lens and the camera body is retained. The aperture is therefore only stopped down as the shutter is pressed and you can frame up the picture and focus at full aperture.

Masks *like these allow many bench-top copiers to handle slides of various sizes up to 6 × 6 cm*

Bench slide copiers

Bench slide copiers are really intended for professional or semi-professional users, and normally cost at least twice as much as a bellows unit. If, however, you need to make a large number of high quality duplicates, the extra cost may be worthwhile.

Bench slide copiers are simply fixed bellows units, mounted on a vertical column and with a special controlled light source at the bottom. Usually, this is an electronic flash powered by mains supply.

The facilities available vary from model to model. The Bowens Illumitran, for instance, one of the most advanced —and expensive—bench slide copiers, has a built-in exposure meter with which you can test the density of a slide against a test slide. It also has a built-in bright viewing lamp, an adjustable

flash for exposure and scales for control of magnification ranging from half the size of the original to over double. Optional attachments include a device to reduce contrast in the copy slide, a box for copying 5 × 4 inch transparencies and separate stands for larger cameras like the Hasselblad.

The Illumitran has a drawer to hold the colour correction filters, and a range of carriers to hold mounted slides or strips of film. Adjustment of the original slide can only be made in one direction so it is difficult, for example, to enlarge just one corner of a slide. If you want to make a selective enlargement you are limited to the central area of the image.

Some other bench copiers use continuous tungsten illumination with variable filters resembling those found in colour enlargers. These match the colour slide film currently available from Kodak, which has low contrast but is balanced for tungsten light. If daylight slide film is used, the correct filtration has to be dialled in first.

Copying lenses

While bellows and bench top copiers can be used with SLR standard 50 mm lenses, these lenses do not necessarily give the best results—particularly the faster lenses. Much better copies are possible with a 50 mm macro lens or a good 50 mm colour enlarger lens. Enlarger lenses are particularly useful for slide copying since they are corrected for flat field (i.e. for producing a flat image from a flat subject). Some manufacturers, like Olympus, make a special range of lenses to fit bellow units.

Another point worth bearing in mind is that it may not be possible to achieve the full range of reproduction scales with a bench top copier unless 60 or 65 mm lenses are used. Telephoto, wide angle or zoom lenses are unsuitable for use with either bellows or bench-top copiers.

There are some lenses recommended specially for slide copying. They are often expensive and have very limited alternative uses. They include the 60 mm Rodagon (enlarging lens), the 63 mm El-Nikkor (enlarging lens) and a 50 mm Repro Claron—a lens for making printers' separation negatives from 35 mm slides.

Slide copying attachments form a useful addition to your equipment stock. Many of them are relatively inexpensive and they enable you to file away your precious original transparencies, keeping them in pristine conditions for slide shows and other special occasions.

Dave King/courtesy of Nikon

Dave King/courtesy of Bowens

Bellows copier (*top*) *For colour correction or improvement, a range of colour compensation filters can be used in conjunction with many types of bellows and slide copying attachments*

The Bowens Illumitran *is one of the most advanced bench-top slide copiers. It can produce duplicates almost indistinguishable from the originals*

Chris Kapolka

Creative approach

Railways

The atmosphere, machinery and general bustle of railways can provide fascinating action shots and interesting studies for the creative photographer

Talk to photographers of 'railway pictures' and many instantly think of the dull record shots that often appear in specialist magazines—shots showing locomotives in a stark clarity that tends to appeal only to the dedicated enthusiast. But the power and motion of railway machinery, the highly individual architecture and the constant flow of passengers can provide a rich source of photographic material even for the photographer who regards trains simply as a means of transport.

Certainly, railways do not hold quite the same power over the imagination that they once did—the days of the 'iron horse' of the pioneer are long since gone and small boys no longer seem to dream of being engine drivers. Unless it is very unusual, therefore, a straightforward shot of a train will have little general appeal, and it is up to the photographer to invest it with interest.

Because railways are, in essence, about movement, an obvious approach is to photograph trains on the move. But if you simply head for the nearest railway line, wait for a train to pass and press the shutter, the chances are that the results will be disappointing.

First of all, you must choose your viewpoint carefully. You should frame the train so that it forms part of an interesting composition or makes a strong composition in itself. A shot that shows little but a train moving straight across the frame, for instance, rarely makes a good picture—unless the viewpoint is sufficiently distant to make it part of a general landscape. A far stronger composition may be obtained by shooting the train rounding a curve or climbing a hill, or by finding a high, fairly close viewpoint so that the train and tracks form strong diagonals in the picture.

Of course, one of the biggest problems can be simply finding a clear view of the train. In towns, it can often be difficult to see the railway until you are almost on top of it—by which time you may be too close for an effective composition. Look for a high building where you can shoot down on the train snaking through the city. Or a viaduct or embankment that raises the railway above the houses—if you shoot late in the day with the sun on the far side of the viaduct, you may get an effective silhouette that shows up the outline of the train nicely, with the sun glinting between the wheels and through the carriage windows.

Another place where you may get a clear view of the railway is in the industrial areas through which railways are often routed—particularly those areas that are a little rundown and where demolition has removed some of the obstructions.

Perhaps the best policy, though, is to move out of the city altogether. In the country, there are many more opportunities for an unobstructed view and you have far more choice in composition. In remote, hilly regions, for instance, even a fairly distant viewpoint will show the

Barry Lewis/Network

Penny Tweedie/Colorific

Loading mailbags *Station activities can make lively pictures, but must be well composed to ensure the subject is not lost against the background. Use a medium telephoto to aid tight framing and selective focusing.*
Steamed up *Steam engines look best when belching smoke, as in this picture of the famous British loco, the Flying Scotsman. So look for steep uphill gradients where the engine has to work hard.* **Black and white** *Good railway shots can be taken even in poor weather —a thin snow cover, for instance, helps to bring out the pattern of the dark rails*

a sleek high speed train shooting past behind people labouring in the fields in the traditional manner.

In both town or country, however, you may find that the view of the train is never completely clear because of telegraph wires, overhead power cables and trackside paraphernalia—all the more awkward because you can frequently fail to notice them. They can rarely be excluded from a railway shot altogether and the best approach is to be constantly aware that they might intrude into the shot and choose your viewpoint to minimize their effect.

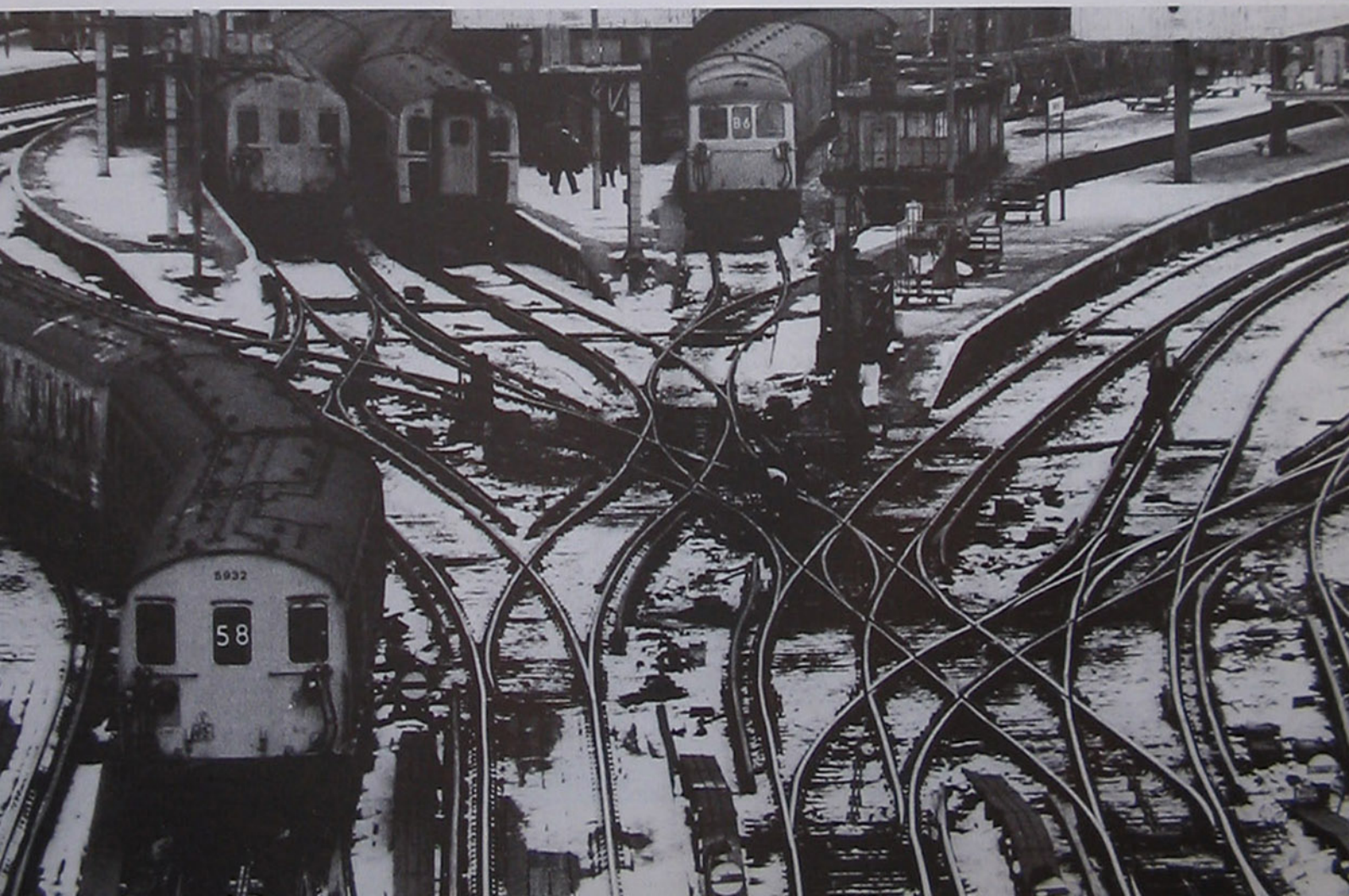
For the best results, though, you must carefully choose not only your viewpoint but also the time of day. Because trains are long, high and harrow, the range of suitable lighting conditions is often fairly limited—it may only be possible to take your shots between certain hours of the day. It may be worth getting a timetable so that you know exactly when the train will pass.

Where the train service is frequent, there is rarely much of a problem: you simply wait for the right lighting conditions. Where the service is infrequent, however, the track may be in shadow when the only train passes. In this case, you must work out in advance where the light falls best at the moment the train goes through and choose an appropriate viewpoint—of course, if the train is late, you may not get your picture!

Choice of lighting conditions depends largely on the type of shot you want. If you want plenty of detail in the shot, perhaps because the train is exception-

train effectively because there are few distractions—you could simply make the train part of a general landscape shot.

In flatter country, particularly where the train is slightly raised on an embankment, extra foreground interest can make all the difference. A popular approach is to contrast the railway with another means of transport—illustrating the march of progress. The foreground could be, for instance, an old canal or a donkey cart on a dusty road, or a multi-lane highway. Alternatively, you could use the foreground to make slightly more pointed social comment—showing



John de Visser

A driver and his engine *An obvious but effective type of portrait, using a wide lens to include the 'tools of the trade'*

ally interesting, the sun should be fairly high in the sky. For a more dramatic but less revealing shot, shoot when the sun is low in the sky and try to catch reflections from the glass or metal work. Steam trains in particular benefit from lighting that creates mood and atmosphere—the steam backlit against a lowering sky, for instance. Shots on snowy mornings with an almost monochrome look can also be very effective.

Whatever the lighting, though, shots of moving trains which convey no sense of movement can often be disappointing. With steam trains, the trail of smoke billowing from the stack and pistons and the blur of the engine's large driving wheels and connecting rods may give all the clues to motion necessary. With diesel and electric trains, however, you must generally blur the picture slightly with a slow shutter speed to create an impression of speed—either panning to keep the train sharp or keeping the camera steady and the train blurred.

Obviously, the blurring effect varies with viewpoint—with a distant or oblique viewpoint, the train must be moving very fast or you must use a very slow shutter speed indeed to give a sufficiently blurred image. If there are many trains on the line, you may be able to work out just what shutter speed you need by estimating how long a train takes to move a significant distance through the frame. A typical shutter speed might be 1/30 second when you shoot from about 500 metres on a 135 mm lens.

Some types of train benefit more than others from this treatment. High speed trains, for instance, are designed to look streamlined—windows are long and low, paintwork patterns are generally aligned horizontally and the front is often aerodynamically styled. Local commuter trains, however, tend to have flatter fronts and taller, narrower windows, and high speed panned shots can look rather odd. With a low and fairly close viewpoint, oblique shots along the train can create an interesting effect. While the front of the train, near to the camera, is very blurred, movement of the end of the train far away from the camera, may be virtually undetectable. This progressive blurring, combined with steep perspective, can create an unusual, often impressive effect.

Night shots with a slow shutter can also be effective—showing the moving train lights in a single blurred highlight,

with perhaps the red lights at the rear of the train included to give some reference point. If the railway is electrified, you may be able to discover a point on the line where a spark is always produced. Try lining the camera up on this spot at dusk so that the spark can be seen clearly, but the silhouetted outline of the train remains visible against the evening sky.

Shots of trains can often be given extra interest by including railwaymen in the shot—a level crossing operator or men working on the line, for instance, against a blurred image of a train speeding past. Work on the railway might even make an interesting subject in itself. The nature of the work varies tremendously from place to place and with the type of train. Early morning preparations may be entirely different in one part of the world to those in another. Photographing railway work, therefore, may be an effective way of capturing the individual character of the railway.

Of course, one of the continual problems with railway photography is access. In some countries, you may not be allowed to photograph early preparations in the yard—it may even be illegal. In others, there may be no problem at all. It is important to find out from the railway authorities just what you can and cannot do. Even in places where photographers are not normally allowed, you may be able to gain access by proving that you have a responsible attitude.

Naturally, because of the problems of access, many people prefer to shoot trains standing in the station rather than on the move. Unfortunately, you can rarely see the trains from very far away when they are in the station. Wide angle shots may suit some trains but not others. The streamlined shape of high speed trains, for instance, can often be enhanced by an oblique frontal shot from the platform giving very steep perspective. This kind of shot rarely looks as effective with older trains, however.

In the station, then, it is probably better to close in and concentrate on details. With carriages, for instance, windows tend to be identical and a shot including a single window is often sufficient. Indeed, a shot of a carriage window can often convey what the ride is actually like more effectively than any number of shots of the whole train. A passenger in the window may complete the impression.

Other small details may capture the character of the railway equally effectively—the worn, polished wood and the painted shutters on the old trains of the Third World or the bright logos on modern diesel trains. Look for these indicators and isolate them.

Alternatively, you can look for close-ups that make effective pictures in their own right. The mechanical detail on the engines and on the carriages—bogies and buffers—can make fascinating textural studies.

By isolating less obvious areas of bright coachwork—particularly where there are strong colour contrasts or patterns—or by shooting from unusual angles, you may find good abstract material.

Again, though, you may find that you are not allowed to photograph the trains close up. Few railway authorities take kindly to photographers setting up tripods on the platform, for instance, and most shots have to be hand-held. Since many stations are covered and fairly gloomy, fast film is therefore essential. It is also important to have a good selection of lenses, preferably including a zoom, so that you can achieve the framing you want from a limited range of viewpoints.

If you prefer to work under less pressure, it may be worth going to places where the trains are meant to be looked at—at railway museums or on special lines built as tourist attractions or restored by railway enthusiasts. Although sometimes the organizers reserve the right to take their own pictures, usually photography is much easier in these locations and you can often walk right up to the trains for extreme close-ups—you may even be able to get underneath for some unusual shots.

Lines at sunset *Shooting into a low angle sun turns the rails into a tracery of golden lines*

Van Dyck Bucher/Photo Researchers

High speed train *Use blur creatively to suggest movement. Here a starburst filter adds a modern, streamlined effect*

Courtesy of British Railways Board

Detail shots of old steam engines and old coaches in the museums, with their glossy paintwork, beautiful polished metal and woodwork, can make very attractive colour photographs but for maximum effect the pictures must be pin sharp and colour rendition must be accurate. Use a slow, fine grain film such as a Kodachrome if there is sufficient light and take your time over framing, focusing and shooting. With so many shiny surfaces around, brilliant reflections can cause all kinds of problems and, for outdoor exhibitions, it is easier to shoot on bright, cloudy days when the light is softer than on sunny days, and use the appropriate filtration where necessary for correct colour balance (see page 431).

Although rainy weather may spoil your enjoyment of these outdoor railway museums, it need not spoil your photographs. Sombre lighting on the wet, grey iron surfaces of the locomotives gives them much more solidity and weight. Shots into the light, giving an almost monochrome result, can be particularly effective. A low viewpoint also helps to emphasise the power and weight of the engines — particularly with steam engines where you can close in on the massive driving wheels and conrods.

Of course, railway photography need not only be of the locomotives and rolling stock—station architecture, passengers, trackside fixtures and the tracks in particular give plenty of scope for the photographer. The strong patterns of the railway lines can often make pictures in themselves. Shots of marshalling yards are popular with professionals and can be very effective, but you need a high viewpoint for the pattern to show clearly. Alternatively, you could shoot from a bridge using a telephoto lens to compress perspective. This kind of shot is often better suited to snowy or misty weather which obscures distracting detail between the tracks.

The clear perspective of parallel tracks receding into the distance can also provide strong, almost abstract photographs. Highlights created by reflections from the rails—from a sinking sun or in wet weather—help to lift such pictures out of the ordinary. Again, a long telephoto might weaken the perspective effect, but it also emphasises any deformities in the rails and the haze that often hangs above the track.

Railway architecture is typified by markedly idiosyncratic styles and the major terminals are often more rewarding photographically than many more famous buildings. Try isolating the features that make the style of architecture so distinctive. Once you begin shooting, you will find that the range of possibilities is immense and it can be useful to isolate a theme and follow it through as you travel by train at home or abroad. Most stations have clocks, for instance, and while many are plain and simple, there are also many weird and wonderful clocks ranging from elaborate Victorian gothic towers to colourful art nouveau faces. A study of station clocks could make a fascinating series.

Finally, the constant flow of passengers on the railway provides an endless source of human interest photographs. A busy station is an ideal place to look for candid shots of all types, but you could try to capture in your pictures something of what it means to travel by train—whether you isolate a single commuter waiting for his train or move to a high viewpoint to show a blurred sea of faces as people pour off trains in the rush hour.

Marshalling yard *This aerial view shows the pattern of trucks clearly, but a lower viewpoint may be equally effective with a telephoto to compress perspective*
Wheels *A close-up shot into the light can give a monochrome effect that suggests the engine's power and weight, enhanced by a low viewpoint*

James A. Sugar/Susan Griggs Agency

What went wrong?

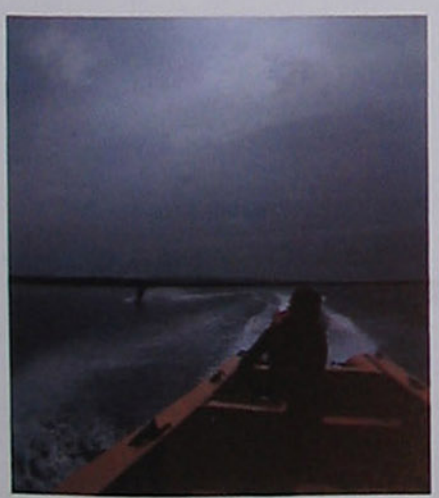
Wide angle shots

A wide angle lens is a useful and popular accessory, but in some circumstances it can give distorted pictures

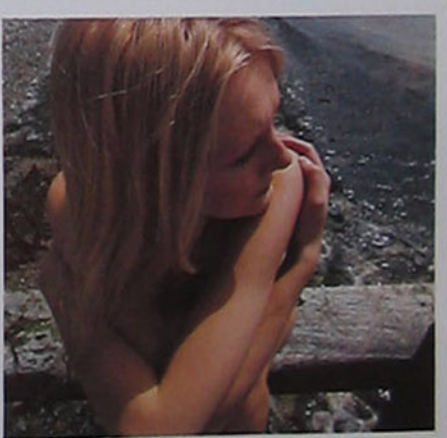
While a wide angle lens allows you to include a wide view, details often become so small, as above, that there is nothing to attract the attention. A better approach would have been to adopt a low viewpoint, making full use of the wide angle's depth of field. The furrows would have dominated the shot, but they would have led the eye to the scarecrow. Similarly, the centre picture lacks interesting features: as in the left-hand shot, the horizon bisects the shot unattractively. Foreground detail though, helps lead the eye into the view beyond (above) and helps fill what would otherwise be an empty expanse

A wide angle was a good choice of lens for the above picture, as it linked the boat and the skier without requiring a very fast shutter speed. Depth of field is also good. But in the lower picture,

You must always expect the phenomenon called converging verticals when tilting a camera to include the complete height of a building. This problem can be especially troublesome with wide angles because one is tempted to use the full covering power in just this sort of application. It is easy to overlook this when taking the picture, so the striking pictures which one anticipates rarely materialize



turning the camera for a vertical shot has included the sun, resulting in severe underexposure as the meter compensated for the brightness of the scene



An extreme wide angle lens was used for both these shots, highlighting the kind of problem you can expect with a subject of this type. The distortion of the model's feet (left) is completely unacceptable and very unflattering. But by 'tidying up' arms and legs to within the middle parts of the image, it is possible to minimize the bad effects of distortion, which is none the-less still evident

Ian McKinnell

Assignment

LAS VEGAS

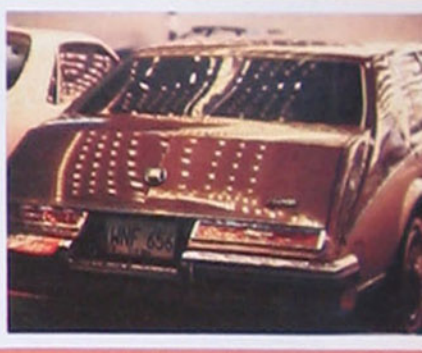
Sergio Dorantes

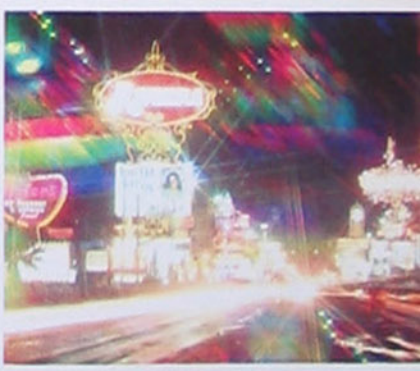
Las Vegas—city of excesses of every manner—presents such a range of subjects that the unwary photographer can easily be overwhelmed

Las Vegas teems with bright lights, bizarre people and buildings and vivid colours. For the creative photographer, the problem is more one of deciding what to leave out than searching to find interesting features to include.

Out of the maze of striking buildings, lights and signs, Sergio Dorantes managed to isolate some fascinating sub-

After the rain *The Kiron 28-85 mm lens was set at about 50 mm on f/11. A tripod was used to allow a 3 second exposure.* **Streaking** *This effect was achieve by using an 80-200 mm lens at f/8 and zooming in during the* $\frac{1}{2}$ *sec exposure.* **Car** *The reflections needed no special effects to create extra interest.* $\frac{1}{4}$ *sec and, f/11.* **Golden Nugget** *Turning a repeating filter during a one second exposure created a feeling of movement.* **Lights of the Strip** *A rainbow filter was used to introduce extra colour to the scene* **Circus Circus,** *For a final night shot, Sergio used a six face repeating filter and combined it with the effect of pulling zoom during the 1/15 second exposure. Setting the lens at 200 mm, Sergio quickly moved the zoom control forward*





Sergio Dorantes

John Heseltine

Las Vegas Boulevard. *To compress the essential parts of the Strip together—the signs and the busy traffic—Sergio used a 300 mm lens.* **Motel sign** *The bright colours of Las Vegas and the deep blue sky gave plenty of scope for creative compositions.* **Reflections** *At the entrances to the casinos, there was as much to photograph overhead as on the ground.* **Cabaret** *This billboard caught Sergio's eye, but he waited until someone passed before shooting*

jects. Initially the town appeared to be an ideal place for colour photography but Sergio knows that you have to be careful to avoid abusing this riot of colour—and to resist the temptation of combining too many colours in a single image.

In taking photographs which will be shown to people who have never visited a place before, you have to include plenty of shots which are linked to an outsiders' expectations and associations of Las Vegas. There is no point in spending the time photographing the wild flowers or the cars if you are trying to capture the character of the town for those back home. You have to deal with the bright lights, the casinos, and other common sights.

For this reason, Sergio spent a lot of his time photographing the night lights. He took many of these shots just after the sun had gone down and while there was still some blue left in the sky. This avoided having totally black backgrounds in all the images. In addition to some 'straight' shots of the lights, Sergio also took several photographs which show how special effects can be created by using filters or by zooming in on the subject during the exposure. A tripod is essential equipment for such techniques.

In the daytime Sergio walked up and down the street photographing everything which attracted him. The entrances to the casinos were full of activity and the ornamental facades made an interesting background. Photography is banned inside the casinos themselves and Sergio narrowly avoided having his film removed from his camera by a very large security guard.

The 44°C heat made photography particularly difficult—especially when it involved carrying around a tripod and heavy camera bags. In this heat the film must be kept as cool as possible and Sergio always took precautions to protect it. The diaphragm in his 105 mm lens suddenly developed a fault and a motor drive stopped working—apparently because it had become so hot. In addition to his usual range of Nikon cameras and lenses, Sergio also carried a Kiron 28-85 mm zoom which he found useful for taking quick grab shots and for photographing the city lights.

Working with scale models

Photographing models can be fascinating. However, the problems of making a small scene appear lifelike are considerable, and special techniques are needed

For the most spectacular special effects, such as the starship gliding in to land on an alien planet, or the supertanker exploding in a ball of flame, movie makers invariably use scale models. While you may not have the resources to build models on the Hollywood scale, you can use models to create a whole variety of special effects on the kitchen table or workbench.

With close attention to detail, careful lighting and the right framing and focusing, you can take pictures of exotic machinery or locations that look just like the real thing. And by skilfully combining photographs of scale models and shots of the real world, you can build up very convincing illusions in pictures that you could never achieve in any other way.

To make the model look convincing, it is essential to understand the nature of scale modelling. By definition, it is the creation of a perfect miniature version of the original, with everything, where practical, reduced in proportion to the overall scale. A 1/32 scale model of a military tank is 32 times smaller than the vehicle on which it is based, not only in its basic structure, but also in all its fittings—wheels, tracks, hatches, even rivets. Moreover, the finish of the model should also be 32 times finer, and it is a measure of how well a scale model is built that the smooth surfaces are ultra-smooth, that sharp edges are not blunted, and that the overall impression is one of high precision.

A scale model carefully mimics the original, but all the effort used in building the model is wasted if it is carelessly photographed. This means that the lighting, the choice of lens focal length, camera position and all other details must be matched to the size of the model. If you overlook this, and simply photograph the model as you would any other small object, you waste the opportunity of taking scale model photography to its logical conclusion—that of convincing your viewers that they are looking not at a model, but at the real thing in the picture.

Building a model

A wealth of information about model building is available elsewhere, in books and magazines devoted to the subject. But there are certain technical considerations which should be borne in mind when building a model, if it is to be used in a photograph, rather than as a model for display in its own right.

First, remember that the camera only sees the model from one angle at a time, so that the remainder of it, facing away from the lens, is irrelevant as far as the final picture is concerned. If the model itself is of no value to you after you have photographed it, you may choose to construct only one part of it, which can mean a big saving in time and effort. This technique is called *viewpoint construction*, and sometimes has the added advantage that the model can be mounted on a support which projects from the background, but is invisible to the camera. This is useful for aircraft and similar models.

A second principle which affects models to be photographed is that they should be constructed with just enough fine detail as the photograph demands, and no more. This level of detail is sometimes more, but often less, than is needed on a regular scale model which simply stands on a shelf.

The amount of detail that you need to build in depends on a number of factors: the absolute size of the final photograph, the size of the model in relation to the size of its image on the print, the resolution of the lens, the graininess of the film, and so on. For example, a typical jet fighter from a plastic kit measures rather less than 30 cm long, and if its image fills a 20×25 cm print, then reproduction is almost life size. Constructing and painting the model so that detail is convincing is almost impossible at this scale, but if the plane is only going to occupy a small part of the picture, perhaps with other aircraft against a sky background, it is possible to incorporate much less detail without sacrificing picture realism.

John Wylie

Invading tank *Military models like this are popular, because it is easy to create a realistic effect. Notice how the photographer has shot from 'ground level' to give a realistic viewpoint*

Michael Freeman

With experience, the right level of detail is easy to judge, but if you are a beginner, it is a good idea to take a test shot while the model building is in progress, and then make your assessment from the picture. If it looks convincing, stop work, but if not, you must be even more meticulous.

Attention to detail takes up so much time, but is important as it is the yardstick by which people judge the quality of model and photographs. For this reason, it is worthwhile making a special effort on one prominent detail of the model. If you can achieve a really stunning level of intricacy in an obvious place, this helps to convince sceptics and mistake-spotters. A sequence in the science fiction film *2001—A Space Odyssey* showed a rotating space station, through one window of which could be seen a complete control room with figures moving round inside. This detail was tiny on the screen but it successfully made the illusion convincing. Always try and include similar key detail on your own models. Alternatively, leave a suitable space for printing in real detail in the darkroom.

Photographing the model

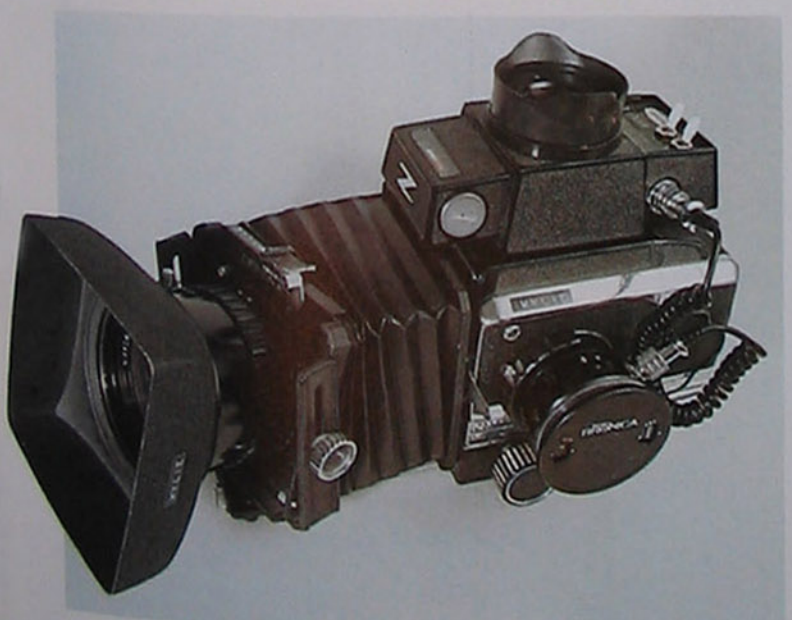
For this kind of close-up photography, a reflex camera is essential. It enables you to see exactly what is going to appear on film, and to visually check depth of field, by stopping the lens down to the working aperture.

Given that you have built your model, and are ready to set up the camera, there are four major points to consider: perspective, scale lighting, setting and backgrounds, and finally, depth of field. If a photograph is to look convincing, all these factors must be considered.

Perspective is important because it is what gives us an impression of the size of the objects within our field of view. If you stand close to a building and look up at it, its perspective is very obvious, and its sides (which we know are parallel) appear to converge towards the top. If you look at a scale model of the same building, you do not normally see this convergence. This is because we look at models from above, a viewpoint that is roughly equivalent to looking at the real thing from an aircraft. Walking round in real life, we see things from ground level, and often quite close, and

Saturn *For this striking effect, several exposures were made on a large format negative. Each element was individually photographed against a black background. Foreground is a real desert landscape, the glow under the spacecraft comes from a transparency of the run, while Saturn itself is a painting and the moon a globe covered in plaster. Nine transparencies were used altogether.* **Table top** *This example of the set-up for shooting a model shows how you need only construct the parts of the set that will be seen. Notice the diffused fill-in light, used to soften the shadows cast by the main light. Both lights are placed well back from the model.* **Special lenses** *These lenses can control both perspective—by altering the convergence of parallel lines—and depth of field—by tilting the plane of maximum sharpness in relation to the film plane*

John Wylie



John Wylie

Louis-Yves Loral/Explorer

Desert city *Large models can be very realistic shot with a natural background using sunlight. The model itself hides the immediate out of scale background*

this is the kind of viewpoint which you must try and recreate in your photographs of a model.

The first and most obvious way of doing this is to use a wide angle lens, and to move in close to the model. The most appropriate focal length depends on the scale of the model, and the amount of distortion that is acceptable. For a 1/32 scale model, a 28 mm or 35 mm lens is best, but you can use lenses as short as 24 mm or 20 mm.

An important consideration when deciding which lens to use is its smallest aperture—the highest *f*-number. Many lenses stop down no smaller than *f*/16, which does not give adequate depth of field. It is preferable to be able to stop down to *f*/22 or even further. You may even buy a lens with a small working aperture with this aim in mind.

At small apertures, definition worsens as a result of diffraction. However, it is preferable to have an image which lacks the finest detail but is convincing rather than one which appears unrealistic through poor depth of field.

With architectural models, use of wide angle lenses may bring the same problems of converging verticals that face the photographer of real buildings. But a model photographer is in a privileged position in that he or she has a wider choice of viewpoint, and can easily raise the camera up off the 'ground'. By positioning the camera at about half the height of the model, it can usually be framed satisfactorily without pointing the camera upwards. If, on the other hand, you are using a view camera or a perspective control lens (see page 778), you can simply raise the lens to produce the same effect, while keeping the camera level with the baseboard of the model.

Perspective is influenced not only by how high the camera is, but also how close it is to the model. The limit on how close in you can move is normally set by depth of field, but experienced modellers 'cheat', and use *false perspective*. This is the construction of the model in such a way that the parts of it which are farthest from the camera are built to a smaller scale than those nearer to the camera, so that the whole model is squeezed into a smaller space. Although this avoids or reduces depth of field problems, it is a complex technique, which needs a lot of effort if it is to be convincing.

The apparent convergence of parallel lines is called *linear perspective*, but there is another type of perspective which is familiar to anyone who has taken photographs on a hazy day. This is *aerial perspective*—the progressive weakening and lightening of a view at increasing distance due to atmospheric haze. This is inevitably missing from a model. If the model is supposed to represent a view with a depth of several kilometres, in which aerial perspective would be obvious, smoke or artificial fog can sometimes help to give the required hazy appearance. Fog making machines, and solid carbon dioxide chips (dry ice) are commonly used, but for the amateur photographer, cigarette smoke is a more practical alternative. It works best on large models, and can be emphasised by backlighting, and by boxing in the model so the smoke does not escape.

The second major consideration in scale model photography is scale lighting, which aims to duplicate the shadows and highlights exactly as they would appear in reality. For instance, clear sunlight produces hard-edged shadows and, because the sun is so distant, the effect is similar whatever the size of the object, whether it is a skyscraper or a person. To reproduce the same effect, you can use the sun to light your models, but if you are working in the more controlled conditions of a studio, you will need to use a very small light source, such as a small portable flash unit or a naked tungsten bulb (clear, not opal).

Position this light at a sufficient distance from the model so that every part of the subject receives effectively the same quantity of light. Otherwise, if the parts of the model farthest from the light are darker, the illusion of sunlight will be destroyed.

A single light source in the studio gives high contrast, and to mimic the reflective properties of sky and clouds you will need to position white card reflectors around the model. For ultimate realism, you could use blue card reflectors to imitate a blue sky, although most photographers prefer to avoid the blue shadows that this produces.

However, as one of the objects of

John Wylie

Ambulance *To make figures appear more lifelike, it is important to arrange them in a natural way. Notice, also, the detail in the pavement and bricks*

Malcolm Russell

model courtesy of Hornby Hobbies

Steam engine *Railway models can make realistic subjects, but must be scaled accurately. Here, realism is lost because of the smoke texture and wide wheels*

photographing scale models is to display as much detail as possible, direct sunlight is not necessarily the best form of natural lighting to imitate. A hazy or cloudy day has fewer shadows and softer shadow edges, and this effect is quite easy to reproduce by diffusing your overhead light source, whatever it is, with opal perspex, tracing paper or a white fabric umbrella. In this case, you may want to use a fill-in light source instead of card reflectors.

In addition to the main lights, consider installing effects lights in your model. You can light up windows by placing small bulbs inside the model, while for very small lights, such as navigation lights on a ship or aircraft, you may be able to use fibre optics connected to a concealed torch, so that light is piped up into the model to point towards the camera. For floodlight effects, such as for an in-flight shot of a night bomber, or for a gantry shot of the Space Shuttle, use small dental mirrors with swivelling heads placed outside the field of view—one light source can be used for a small assembly of these mirrors. Most of these effects lights will be tungsten and rather weak, so that you may need to make two exposures on the same film: one for these and the other for the main lighting.

The third consideration is a satisfactory setting for the model. By placing it in surroundings that resemble real life, you can enhance the realism to an extraordinary degree. Use photographs of the originals from books and magazines for reference and ideas. For military models, a simple landscape is best: rocks, sand and wasteland are easier to imitate than vegetation, which is difficult to reproduce effectively on a small scale. However, you must make sure that the size of the materials composing the terrain is to scale—the texture of sand is much too coarse to be convincing if it surrounds a scale model. Various types of powder are better, such as cement, Fuller's earth and plaster. Baking soda makes passable snow. Use a water spray and modelling tools to vary the texture of these materials.

For skies, a painted backdrop is probably the most commonly used, and allows the models to be positioned easily. It is, however, time consuming. For an aircraft in flight, you can suspend the model horizontally on a pole that pokes through a painted sky: the support remains invisible because it is on the other side of the model from the camera. For night photographs, a basic black background (black velvet, which reflects little light, is ideal) makes it easy to add other features by multiple exposure, such as a moon over a desert landscape with tanks, or a planet and star for a photograph of a model spaceship (see page 513 for multiple exposure technique).

Finally, you must consider depth of field, a problem that is inescapable in model photography. In close-up work there is less depth of field than at normal photographic distances, and in a model photograph, loss of sharpness is an immediate give-away, even to the untrained eye. What makes a picture totally unbelievable is an out of focus foreground, a sharp middle distance, and a soft background.

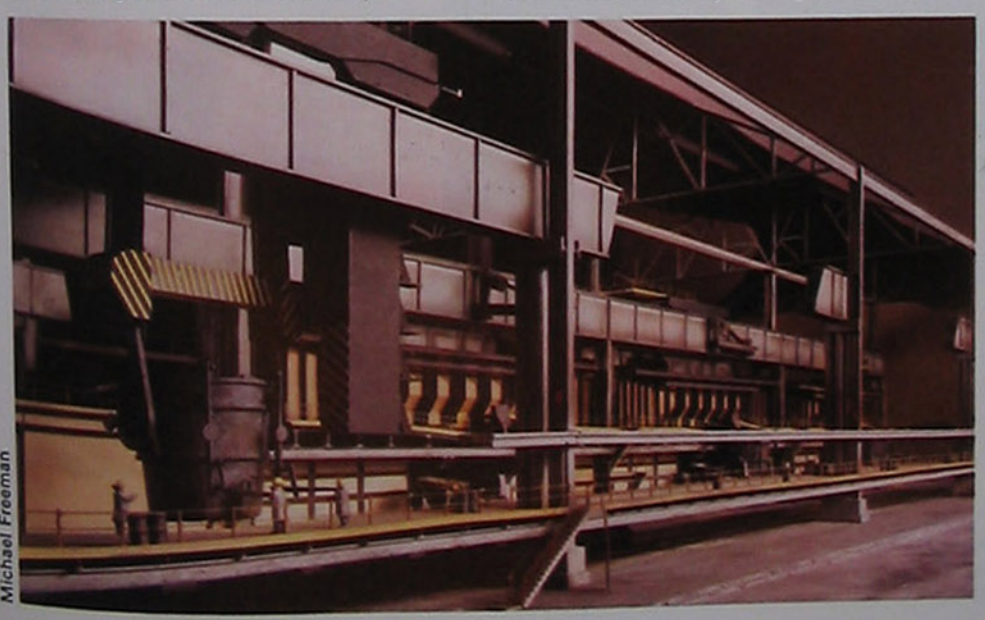
The basic technique is simply to stop down to the smallest possible aperture, and to take extra care in focusing the camera, so that the depth of field is suited to the depth of the model. You can do this either by using depth of field tables for the lens you are using, or by examining the image in the viewfinder very carefully with the lens stopped down. You will need to adjust the camera position or the model with great precision.

With a view camera, you can use the camera's movements—its tilts and swings—to improve sharpness. This control over the image is described in detail on page 779: basically it involves swinging or tilting the front or rear standard until the plane of maximum sharpness corresponds with the plane of the models. For a nearly horizontal model—a landscape, say—tilt either the front standard forwards or the rear standard back.

However, large format cameras suffer the disadvantage that their longer focal length lenses have less depth of field to begin with. Depth of field varies with the focal length, so that one solution to the problem in scale model photography is to use a small format and a fine-grain emulsion, and accept a greater degree of enlargement. Most 35 mm SLR systems include perspective control lenses, and some even include a lens that tilts like a view camera, as well as shifting.

The false perspective described above is also a great aid for improving the depth of field. In addition, multiple exposure, if used judiciously, can help the illusion that the distant parts of the scene are sharply focused—a moon on the horizon, for example.

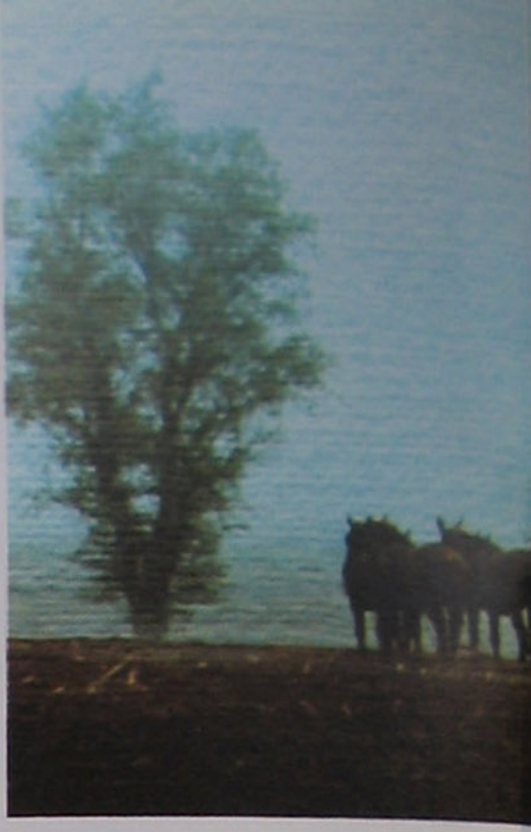
By using these techniques, supplements with your own ingenuity in handling specific situations, the only limit to the realism that you can bring to scale model photography is the amount of effort you put into it. If your models have been built to a high standard, it is only right to do them justice by giving the same attention to detail.



Michael Freeman

Steel works *Despite its realism, this model is only about 150 cm long. It was shot on a large format camera with a wide angle lens. The camera back was swung to make the plane of maximum sharpness lie along the wall. For depth of field, exposure was 20 sec at f/64*

Texture screening



With texture screening techniques, you can make print images which show unusual and highly individual effects

Adding a texture effect to a photograph is an easy way to create extra interest or set a mood. The process is a simple application of combination printing (see pages 360 to 363) that can be used with almost all photographs, whether in black and white or colour. All you need do is sandwich a suitable texture screen with either your negative or your printing material, and make a print in the usual way.

A texture screen is usually a piece of film with an image of an evenly textured surface or a repetitive pattern. Such screens are available commercially, or you can easily make your own.

Printing techniques

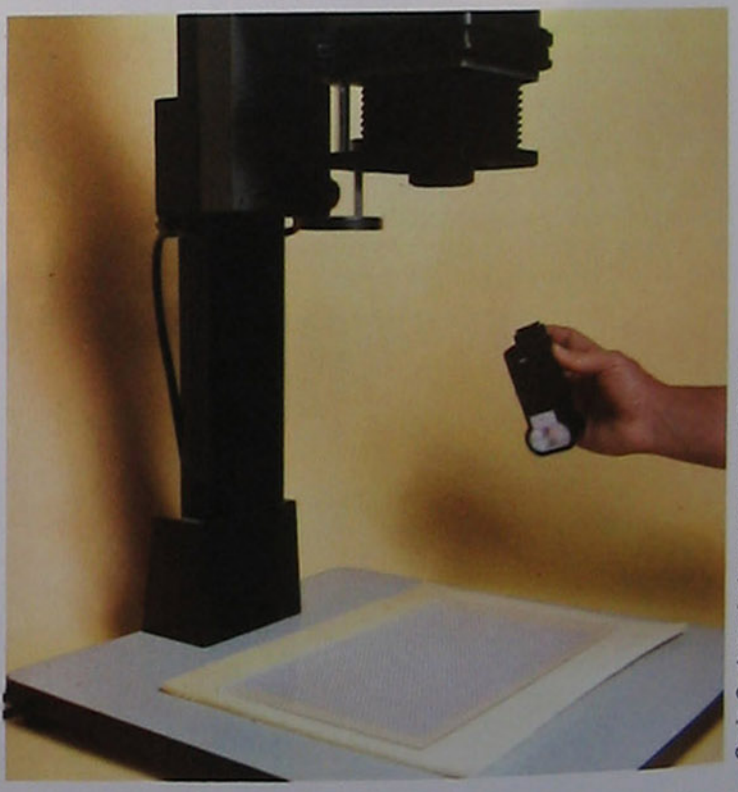
Normally the texture screen and the negative to be printed are placed within the carrier of the enlarger. It is best to use a glass negative carrier to keep the screen and the negative flat and in good contact. Place the negative and the screen so that the two emulsion sides face each other. This gives sharp focus to both screen and negative. Placing the two pieces of film back to back and focusing on the image negative gives a slightly soft out-of-focus texture effect. This effect can be exaggerated by putting a sheet of slide cover glass between the negative and the texture screen. Changing the aperture of the enlarging lens further alters the difference in focus between the image negative and the texture screen.

The other popular way of making a print with an overall texture is to contact print a large texture screen with the paper under the enlarger. Focus the image negative on the masking frame, switch off the enlarger, place a piece of paper in the masking frame and then cover it with a suitably sized texture screen. Sandwich the screen and paper together with a sheet of glass over the top to ensure good contact. When the print is made, the result has an overall texture with the same scale as the screen, regardless of the degree of magnification given to the negative.

Commercial screens

Commercially made screens are generally designed to be used in contact with the negative, and are therefore made to match specific negative sizes—usually either 35 mm or 6×6 cm. The

Ready-made screens *You can buy ready-made texture screens, usually in sets. One type, examples of which are shown here, is printed in contact with the negative. Other types are laid on the print for part or all of the exposure*



Gavin Cochrane/enlarger courtesy of Philips

Home-made screens *One of the simplest ways of making your own texture screens is to contact print a material, such as textured glass, on to suitable sheet film. Or you can make small size screens by copying the original*

Elizabeth Welsh/Tony Stone Associates

Ray Daffurn/Scene International

Pastoral scene *Just the type of subject which can benefit from use of an 'Old Master' canvas-like texture screen*

Portrait *Drawn cotton provides the texture for this picture. The effect is pleasant and not too dominant*

fineness of the texture matches the degree of negative enlargement required by each format. This means that although it is possible to combine a 6×6 cm texture screen with a 35 mm negative, the scale of the texture may overwhelm the smaller image.

Commercial screens have a negative image, and are therefore intended to be used in combination with black and white or colour negatives. The range of available textures covers many patterns to suit a wide variety of subjects.

For this reason, you should think carefully when choosing a commercial texture screen to match a particular negative. The right choice enhances a subject—a poor choice can overwhelm it. For example, canvas-texture screens are suitable for portraits and landscapes, but may look out of place with modern buildings or machinery. For these, a more technical commercial screen such as a rectangular grid, a dot screen, a series of ruled lines or concentric circles may be more appropriate.

Making your own screens

Sometimes you may find that there is no commercially available screen that is just right for a particular negative. You may also find that some of the commercial screens are too commonplace for you—it can be annoying to find that the picture you have entered in a camera club competition, for instance, has exactly the same texture effect as other pictures on display. If you make your own screens, each can be unique. You can even make a screen to match a particular negative.

Simply photograph a suitably textured surface so that it fills the frame, using lighting that reveals the texture most strongly. With surfaces such as stone or fabric, this usually means directional lighting from one side to accentuate the texture with shadows. For other textures, all that is necessary is to ensure that the surface is evenly lit and properly focused. It is wise to bracket exposures and underdevelop your black and white film by about 30 per cent so that you produce a texture screen that is not too dense or contrasty. This allows the subject negative to print with full detail in both highlights and shadows.

A standard lens is usually suitable, but if you want to make a texture screen from a small detail such as the veins on a leaf you may need to use close-up accessories or a macro lens.

Large contact printing texture screens can be made by enlarging suitable negatives or transparencies on to sheets of film a little larger than the final print. You can use either normal continuous tone film or lith film. Processing is best done in a colour print drum if your sheet film is panchromatic.

You can also make texture screens by using special processing techniques. For example, a plain surface photographed on coarse grained film such as Kodak's 2475 Recording film or High Speed Infrared film gives a screen that can be used to add grain to subjects shot on slow speed film. Point your camera at an evenly lit surface such as a wall or a sheet of board, defocus the lens so that you do not record any subject detail, and make a series of exposures at different settings. Aim to overdevelop the film slightly, to accentuate the grain effect. Usually, the best exposure is one that has been somewhat underexposed.

Reticulated film also gives an interesting effect. Expose the film to an even surface as before. Develop the film normally, but instead of using a stop bath, give the film a few rinses in alternately hot and cold water, then fix and dry as normal. Make sure that you do not use water that is hot enough to warp your developing spiral, and that there are no important pictures elsewhere on the roll of film. This process breaks up the emulsion of the film into a crazed pattern that can be effective with some subjects.

High contrast screens

The screens mentioned so far have a low density that adds subtle texture to the final print without affecting the original in too dramatic a way. There are occasions when a high contrast screen may give a more suitable graphic effect. In such cases you can use lith film to make a high contrast screen (see pages 914 to 917). Lith film is available in 35 mm bulk rolls and sheet film sizes. Suitable subjects for these high contrast

Clive Boursnell

Texture in copying *You can introduce texture screening by binding your screen with a suitable original transparency and copying the resulting combination*

texture screens can be very different from the more subtle conventional screens. A macro photograph of an even area of tone in a newspaper illustration gives a dot screen; scrambled rub-down lettering or even a page from a book can each give interesting results. Remember that with high contrast film the lighting has to be carefully considered, particularly if the identity of the subject is to be retained. Bracket your exposures to make sure that at least one frame is usable. The scale of the image on the texture screen is most important and should be carefully judged so that you do not completely obscure the subject on your negative behind an area of opaque black screen.

Ready-made screens

Manufacturers of instant lettering also produce sheets of rub-down textures and tones intended for use by draughtsmen and illustrators. These tone screens can also be applied to sheets of glass. If your enlarger has a glass negative carrier, you can apply a piece of tone sheet to the lower glass carrier to be printed in the same way as a normal texture screen. Alternatively you can place a piece of tone sheet on a large sheet of glass and place it in contact with your printing paper to produce a same-size rather than an enlarged texture.

Nylon stockings, scrim, muslin and other loosely woven fabrics make excellent texture screens when sandwiched between glass in the negative carrier of the enlarger, or when weighted with glass and contact printed on to the paper in the easel under the enlarger.

Textured glass, available in a wide variety of surfaces, can make good ready made texture screens. Glass of this type can often be bought in small cut pieces or as samples from a glazier or hardware shop, or you can have pieces cut specially to size. The glass usually has the texture on one side only. Changing the enlarger focus and placing the glass one way up or the other, either in the enlarger or on the printing paper, can give a range of texture effects from one piece of glass. Some glass, such as the ribbed type, has a very strong texture which can overwhelm a 35 mm negative. This type of glass is better placed on the printing paper or even exposed on the paper separately from the negative, by giving the print a simple double exposure.

Texture vignetting

Sometimes a texture is not needed over the entire surface of the print. A vignette mask can be used to limit the effect to only some areas. This technique is useful for portraits.

For example, you may want to surround the subject of a portrait taken against a light background with texture in order to add a little more interest to the composition. Cut an oval mask from stiff black card to cover the face area and attach it to a dodging wire. Place the portrait negative in the enlarger and set the required size. Expose the paper as if for a normal print. Then replace the negative with a small texture screen and print this on to the paper while gently moving the oval vignetting dodger over the face area during the exposure. This gives a subtle gradation to the edge of the texture effect. Process the print normally.

Colour and texture

Texture screens can be just as useful when making colour prints as when making black and white prints. You can combine texture screens with either colour slides or negatives to produce a range of effects.

For some photographers, a colour slide is the final product. Combining a slide with a texture screen in such a case means simply sandwiching screen and slide together in a mount. A texture screen has to be made for each slide—buying a commercially made screen for each would be very expensive. Such screens can be made in either black and white or colour. Black and white texture screens give a shadowy grey cast to the final slide–screen sandwich unless you use a high contrast lith screen.

To make a colour texture screen, either make an overexposed colour slide of a suitably textured surface, just as you would make a black and white texture screen, or take a black and white texture screen and colour it with toner (see pages 710 to 713). Remember that the density of the slide and the screen are combined, so it is better to use slightly overexposed originals. Often a texture screen added to an overexposed slide can add extra interest to washed out highlights.

Printing colour texture

Combining colour slides or negatives with texture screens to make prints is almost the same as in black and white. There is only one pitfall to beware of: your texture screen should not be shot on colour negative film, even if it is to be combined with a colour negative original. This is because colour negatives incorporate an orange density mask, and combining two such masks leads to difficult print filtration problems. A toned black and white texture screen or a texture screen shot on slide material can be combined with a negative if you want to add coloured texture, but remember that the colours of the screen print as their complementaries on negative to positive colour paper—blue prints as yellow, red as green and so on.

Combining a colour negative with a black and white texture screen creates no special problems, and making textured prints from colour slides on to colour reversal paper is just as straightforward. Large sheets of rub-down texture are particularly useful for adding grain effects to otherwise virtually

grainless prints from slides. You can vary the degree of graininess by making the exposure in two parts, one with the screen in place, the second without.

Using screens with lith

It is possible to create effects in which the screen is not simply superimposed on the image, as with the methods described so far, by using lith film with special screens. The image virtually appears to become part of the screen. Instead of a pattern of dots being superimposed on the image, for example, the image is actually made up of many tiny black dots whose size varies according to the depth of tone of the image. This is the technique used to transform continuous tone photographs, with a range of subtle shades of grey, into *half tones* (see page 1128), where the image is made up entirely of black dots; since these black dots can be reproduced easily with ink the technique is in use in commercial printing.

Printers usually make half tones by using a special vignetted dot screen that automatically translates different negative densities into different sized dots when placed in contact with a sheet of lith film under the enlarger. As the name implies, a vignetted dot screen is made up of many tiny soft-edged dots, the density of which varies according to the distance from the dot centre. In practice this means that the area of lith film that is exposed, and hence the size of the dot produced, depends on the brightness of the exposing light—and this depends on the density of the original negative.

Vignetted dot screens produce an image on lith film that is much the same as that found in newspapers and magazines. Other more interesting screens are available. Straight line screens, that produce an image consisting of parallel lines that vary in thickness according to the image density of the negative, give a less ordinary effect. Screens that give wavy lines, crossed lines, concentric circles and grain effects are also available.

The main disadvantage of these special screens is their high cost and limited availability. They cannot be obtained through normal photographic dealers, but must be ordered from printers' suppliers.

An alternative way of producing much the same effect is to use a high contrast screen held slightly above the sheet of lith on which you are making the print. The screen itself can be made of lith film by printing an ordinary texture screen or a sheet of rub-down tone on to film. When the high contrast screen is placed above the sheet of lith you are printing on, the black pattern of the screen casts shadows into the areas of film being exposed by light from the enlarger. This affects the size of the exposed areas on the lith film, producing dots or lines that vary in size according to the density of the negative in the same way as those produced by a vignetted contact screen. The main disadvantage of this technique is that it is fiddly and uncertain. You may need to make many experiments with different screen-to-film separations, lens aperture settings, and image magnifications before you achieve a satisfactory result.

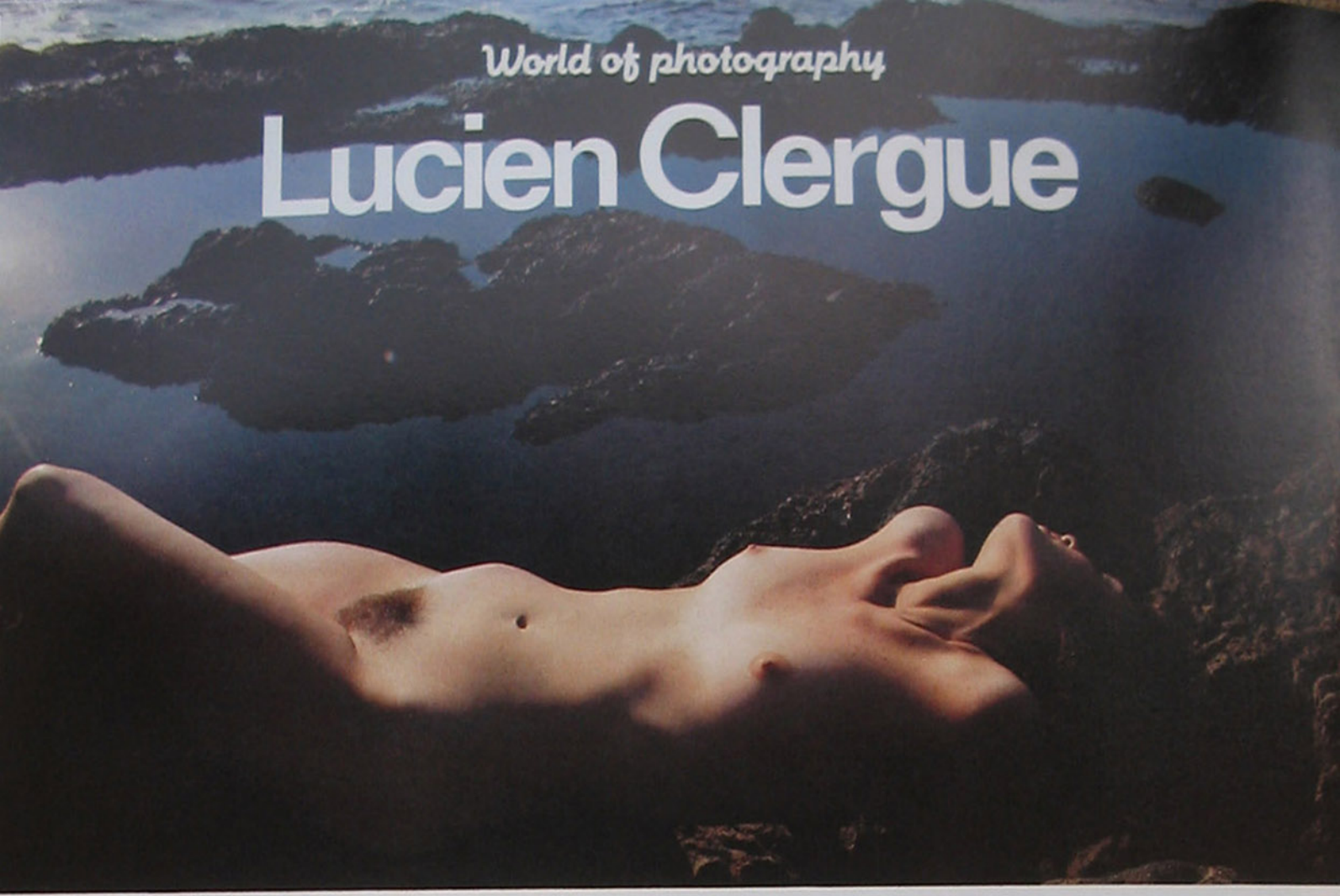
Ray Dalfurn/Scene International

Point made *The fractured nature of the screen used when printing this bold image of two fencers helps strengthen interest in the picture*

Elizabeth Welsh/Tony Stone Associates

Greetings with feeling *Texture screened images are commonly used in the greeting cards industry to produce ethereal moody images*

Lucien Clergue



Although he has worked with a variety of subjects, Lucien Clergue is best known for photographing nudes. He combines the beauty of the form with its symbolic qualities to make some haunting images

'As a young man I was very shy and I took some nude photographs just so I could see a nude woman in front of me.' This rather tentative start marked the beginning of a lifelong interest and eventful career for one of today's most successful photographers of the nude. His images are now reproduced in books and magazines all over the world and his prints sell to a wide audience.

Born in 1934, Clergue grew up in the small and historic town of Arles in the south of France where he still lives with his family. Nearby is the Camargue, a vast flat nature reserve which stretches down to the Mediterranean and this has proved to be an important subject for his photography, as shown by the books *Camargue Secrète* (1976) and *Language des Sables* (1980)—'Language of the Sands'.

Besides being a prolific author, Clergue has proved himself as a documentary film maker, directing award-winning films on the art of bullfighting and the Camargue, the flamenco guitarist Manitas de Plata, and the artist Pablo Picasso. Today, however, Clergue devotes most of his time to the photography of nudes for which he is most widely known and which has been his central subject since he first took up photography at the age of 18.

When Clergue started photographing the nude he found that it offered him a means of coming to terms with various aspects of his life. It represented 'the affirmation of life and the reaching out to beauty and health' that countered his earlier obsession with images of death. 'When I took my first photographs of the nude in the sea I felt totally free and I began to understand the relationship between myself and the past.'

Lucien Clergue had originally taken up photography as a route into the exciting world of bullfights and the theatre. As a young man he had dreamed of being a bullfighter or going on the stage but discovered that his talents did not lie in that direction. So, partly to remain in the theatrical world, he decided to take photographs. Gradually he became increasingly immersed in photography and eventually spent every moment either photographing or printing in the darkroom.

Clergue's early work shows some of that world and, notably, includes the fine series of photographs of 'Les Saltimbanques'—a troupe of young acrobats—which he photographed in and round the ancient ruins of Arles, and the pictures he took of the controversial playwright Jean Cocteau filming his play *Testament of Orphée*. 'My love of the theatre is always present. But I don't like to be in the concert hall as a passive listener. I

Teresa Engle

Lucien Clergue *(above) One of the photographer's favourite settings is the Camargue, where he spends many hours photographing both the landscape (above right) and the female nude. In recent years he has also travelled farther afield in search of a variety of locations—including Point Lobos in California (top). This has long been a favourite location for a wide variety of landscape photographers*

Lucien Clergue

always want to be backstage where everything really happens.'

Both Cocteau and Pablo Picasso were important influences on Clergue's career, giving him encouragement when they felt he deserved it and collaborating on various publishing projects. It was their encouragement and that of other people in the art world that helped him to make the final step from a secure accounting job in a factory to the role of a fulltime professional photographer.

In 1958, while still working at a factory in Arles, Clergue was given his first major exhibition at the famous Kunstgewerbe Museum in Zurich, Switzerland. Here he met two men who were to give him just the help that he needed. The first was a Swiss lawyer and art collector named Staehelin and the second was one of the most influential figures in the history of photography, Edward Steichen.

Staehelin gave Clergue some commissions and bought a large number of his exhibition prints—for a sum which was the equivalent of Clergue's annual income. Steichen, who was then director of photography at the Museum of Modern Art in New York, also bought prints for the museum's collection and was later to invite Clergue to exhibit at the museum.

This combination of public recognition with the realization that he could make a living from his photography made Clergue's mind up for him. By the end of the next year he had resigned his job and was devoting all his energies to photography. In the early 1960s he produced a number of books, including

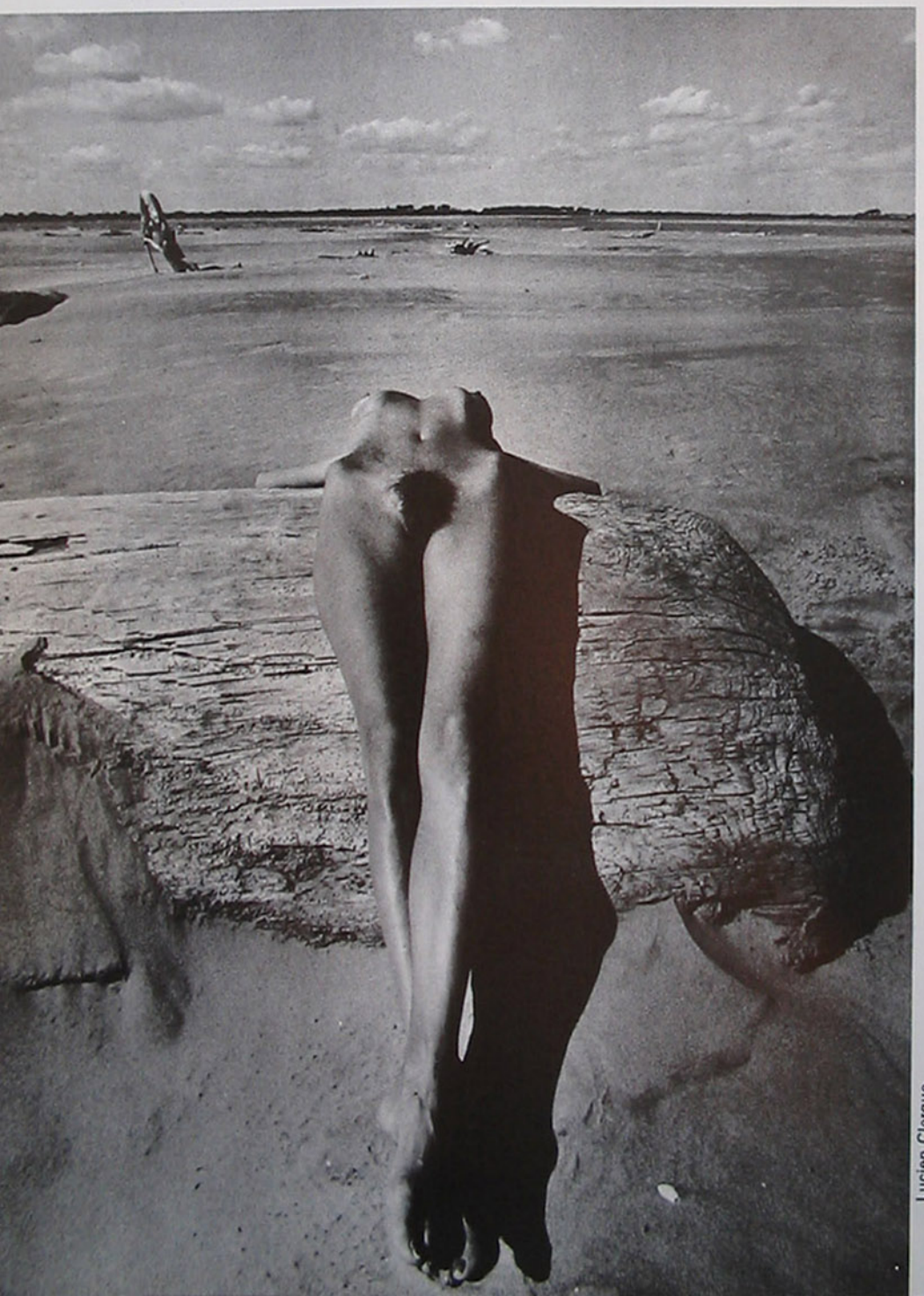
Poesie de Photographie (1960) and *Toros Muertos* (1963)—a celebration of bullfighting—both of which were written by Cocteau.

Bullfighting is an important part of the culture of southern France and was also an important symbol for Clergue. 'In every house here in Arles there is a bull—it's like a god, a kind of divinity that gives people some of their power. People have to touch the bull in order to receive some life. It's also a symbol of fertility and often associated with the figure of a woman.'

Such symbols are an important part of Clergue's life and of his photography. He sees his nudes as mythical figures and expresses this in the way he describes his work. Talking about a photographic session at Point Lobos in California, Clergue is enthusiastic and it is clear that it is important to him to have an emotional relationship with the locations he chooses to photograph in.

'I was very impressed by the place. The ocean works with the rocks and the sand and sea make sculptures out of the sandstone. At the same time there are other rocks there that have remained the same for an eternity. Some of the rocks seem to me like messages from God. The important point is whether or not we are ready to read these messages. Sometimes I feel very sad after my visits there because I don't feel I have understood them.

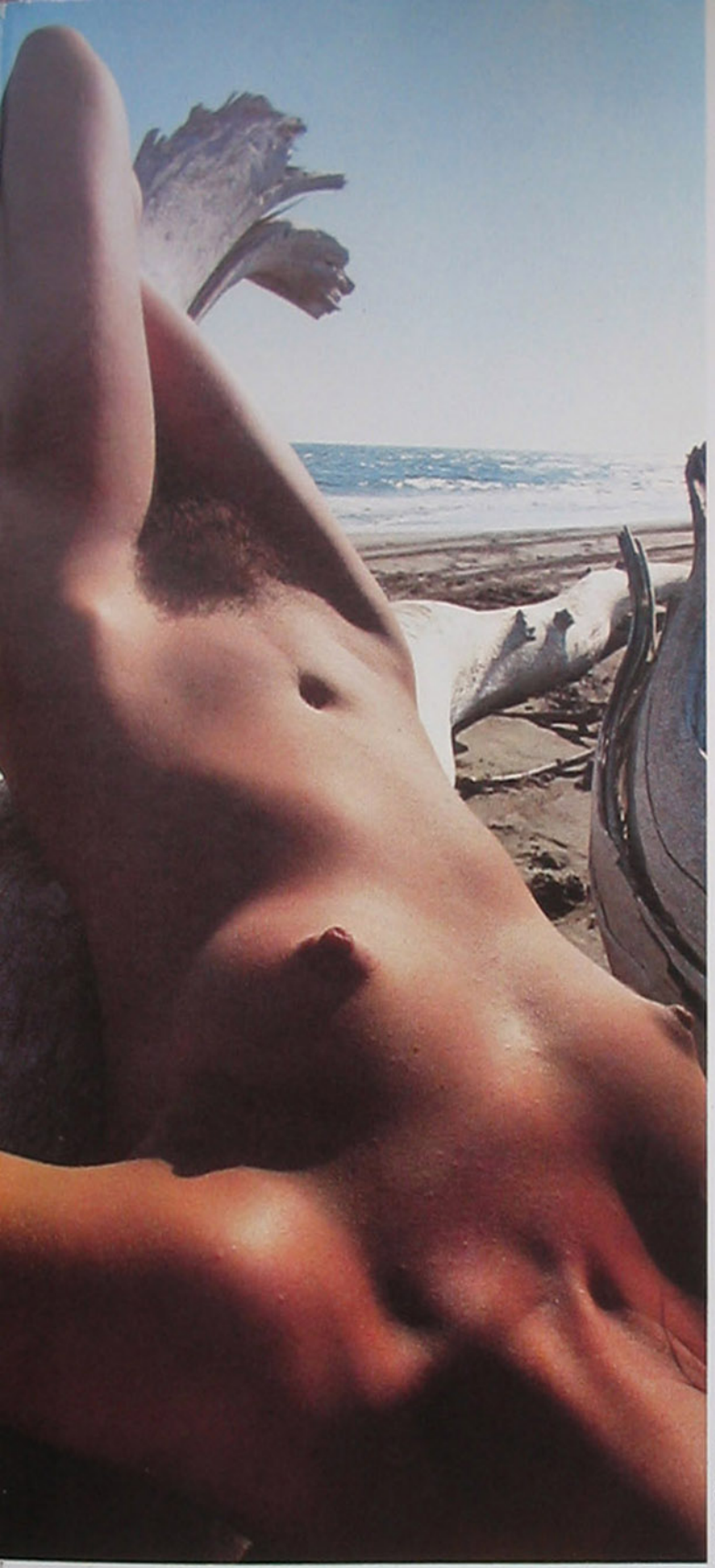
'I was very happy working there with one of my models because she recognized the same thing about the place. We were surrounded by poetry and there was a fantastic smell of old algae dying on the rocks. The power of it all was tremendous. It filled your eyes, your nose and even your ears. You were so far away from civilization and had an enormous feeling of privilege—as if you were surrounded by the gods. It's a strange feeling—but working with someone who reacts the same way as you can produce some interesting new ideas for photographic images.



Lucien Clergue

It is this almost mystical approach to his surroundings and to his photography which influences the major themes in Clergue's work. His photographs represent the union between man and nature.

Clergue's nude photographs can be separated into three distinct themes—the nude in the sea, the nude in the forest and the nude in the city. In the 1960s he worked exclusively with the sea and saw his models as representations of the goddess Venus rising from



Natural forms
Clergue uses photography to explore the relationship between the human body and the natural world. He uses the sky, trees, stones and driftwood in his compositions to complement and contrast with the beauty of the human form. He takes all his pictures in natural light

Lucien Clergue

the sea. These photographs, at first exclusively in black and white and later also in colour, are the best known of all his nudes and illustrate numerous books particularly *Née de la Vague* (1968) and *Genese* (1973).

Later Clergue also photographed nudes in the forest, exploring the idea of Adam and Eve and the primeval forest and enjoying the challenging complexities of light and shadow. Most recently Clergue has been photographing the nude in the city. His urban nudes are generally portrayed as gods and goddesses overwhelming or overseeing the city landscapes beneath them.

As with all his nude photography, Clergue is keen to explore the relationship between the figure and its environment. And as he does so, and becomes interested in different aspects of that relationship, his approach changes. 'At first I really wanted the city to be a prominent part of the picture. Now I'm less interested in it—the interior of the apartment and the relationship between the figures in it have become more important in my photographs.'

Lucien Clergue

Urban nudes *In his latest work, the rounded figures of the human form are contrasted with the city's images*
Nude in shadows *Here the shadows have been used to create an abstract feeling*

Although at the beginning of his career Clergue worked exclusively in black and white, he now enjoys working in colour as well. He sees colour as complementary to his black and white work rather than a replacement of it and often shoots in both black and white and colour at a session. However, there are also some circumstances where he only shoots in colour, as in recent experiments with the Polaroid SX-70.

He tends to use his 35 mm Minolta most of the time, although he occasionally uses a 4 ×5 Sinar camera. He uses very little other equipment besides a tripod and a variety of lenses. The 17 mm lens is a favourite as he likes the extreme depth of field it gives. To achieve this he may use a tripod and very slow shutter speeds to allow small apertures, as he always works by available light.

Almost all Clergue's photography is now concerned with ideas about the nude as a symbol of life. He sees his approach to this as part of an ongoing 'celebration of woman' and states 'I try and show women at their highest level, and this is how I view my models. Sometimes I find myself in front of a nude, a man or a woman, and I suddenly think that they look so great. How can I possibly capture that on film. It's the same with landscapes. I say this is fantastic and I'm here but how can I live up to it?'

Clergue has been attacked for the way he portrays women, but those who accuse him of treating women as objects are probably missing the point. His female nudes are not supposed to be individuals but symbols—representatives of his overall concept of the female, or symbols of various aspects of life.

In recent years Clergue has started to break through an old taboo against photographing the male nude and some of the results are superb. These began with some fine pictures of a young man called Fred who is himself a photographer. Clergue describes the ambiguities of this photography. 'Fred is very masculine but I also saw some elements of femininity in him. In nude photography desire is really part of the game and although I have no real desire for a man, it was strange to discover those elements in myself that I think every man has in him.

'It's somehow embarrassing because you don't expect it but it also makes you realize that men aren't so bad. This is interesting as I think that the relationship between men is about the relationship with the father. So I find photographing male nudes interesting even though I still prefer to photograph women.'

Although nude photography has played such a central role in Clergue's career he has not been exclusively concerned with it and he is keen that the students in the workshops that he occasionally gives learn from other aspects of life. So he is experimenting with music.

'I try to use live music recitals to show my students the relationship between creativity and interpretation. I show them that by giving a composition a particular interpretation a musician is acting in the same way as a photographer in the darkroom. The composition is the negative and it is only when he plays the music that the musician produces the positive.'

'I don't like to be involved in photography as if I were in a cage with photography on every side. I think photography suffers and becomes cold if photographers forget to look around them.' In spite of this Clergue enjoys his involvement in the photographic world and has done a lot to promote photography. In the last decade he has been involved in the running of the annual Rencontres Internationales de Photographie (International Meeting of Photography) at Arles which he was instrumental in founding in 1970.

This is now one of the most important meeting grounds for all those who are involved in the world of photography, particularly art photography. For one week at the beginning of every summer there is an intensive programme of slide shows, films, discussions and seminars about photography which are attended by photographers, editors, teachers, collectors and others. This week is then followed by a two month programme of photographic workshops given by some of the world's leading photographers and photographic theorists. For a total immersion course in the world of photography, the meeting is unrivalled.

Although he has now withdrawn from some of the more time-consuming activities at the Rencontres, Clergue continues to be one of the central figures. However it is just one example of the many projects to which he devotes so much of his legendary reserves of energy. These also include a number of ideas for long-term personal projects.

For the moment though, personal projects have to wait. With a long string of international exhibitions before him and a continuing commitment to teaching and publishing, Clergue has a full programme to work on.

Why pictures age

Photographs can last a long time. But the 'life' of a particular picture can be difficult to predict as many factors affect the deterioration of the image

Barnaby's Picture Library

It is very satisfying to make a really good photograph—one that is perfectly composed, developed and printed. So given the thought, effort and care that go into the production of such a picture, you might imagine that it is now a work of art or a record which will remain for all time. Unfortunately, due to the nature of the image, this is not always the case.

The permanence of the photographic image depends on three major sets of circumstances—the materials which form the image, the processing and the environmental conditions of viewing and storage. These can vary enormously, so it is difficult to give a definite 'life expectancy' for any one picture. The life of a photograph can be defined as the length of time before noticeable change sets in. Such changes, which are due to chemical processes, include fading or loss of density, changes in colour, and the appearance of stains.

A normal black and white print on fibre-based paper, suitably processed and stored, can be expected to last 100 years or more, and such prints are in existence. A similar claim is made for colour prints, as yet without proof other than accelerated ageing tests. The special dyes of materials such as Polacolor and Cibachrome are claimed to be even more resistant to deterioration than conventional prints, again based on ageing tests.

Black and white and colour prints produced without special precautions and handled normally may be expected to have a life of 5 to 25 years or more, but cutting corners on processing reduces this. Mass produced, machine made colour prints, such as the prints from processors who mostly deal in family snaps, may have the shortest life of all.

It has been said that resin coated papers deteriorate faster than the fibre based types. But the actual life of prints on resin coated papers is still unknown. Ageing tests however, suggest a shorter life than fibre based materials.

Colour transparencies made on Kodachrome film are expected to have an archival storage life of 50 years or more. Other reversal processes are not nearly as good, and colour negatives are the worst of all, changing significantly in only five years.

Silver permanence

The metallic silver which forms all black and white images is reasonably stable. Even so, sulphurous gases which may be present in the atmosphere attack the image, turning the black silver to brown silver sulphide. In addition, if the fixer used is partially exhausted and fixing of the image inadequate, traces of silver halide remain. Likewise, if washing is inadequate, traces of complex silver compounds and hypo can be found in the picture. All these compounds decompose to give brown stains of silver sulphide. This process is accelerated by heat, light and gases.

Black and white materials intended for archival storage are very carefully processed.

Mother and child *This photograph has deteriorated over 25 years, and the dyes have faded considerably*

Glamour girl *In this picture the layers of the film have faded at different rates giving an overall cast*

Barnaby's Picture Library

Brown stains *Inadequate washing of a print after fixing can lead to brown marks or stains appearing in the image*

Lila Mann

Sepia pier *The toning of black and white pictures helps prevent fading by changing the structure of the image*

A stop bath and two-bath fixing arrangement is employed, and exhausted chemicals are avoided. In addition, a hypo clear solution, a hypo eliminator and thorough washing are used.

The hypo clear solution aids the removal of residual fixer, while the hypo eliminator chemically attacks and renders harmless any final traces of hypo. In this way, every last drop of fixer is removed, and the washing takes care of the silver compounds. As a check, processed prints can be 'spot tested' by suitable solutions to reveal any traces of silver salts or hypo.

To pre-empt staining, the image may be deliberately toned using sulphide, selenium or gold toning solutions. This effectively changes the silver image and converts it to one formed by silver compounds or gold coating, which are more stable. Prints on resin coated paper may be treated in a similar manner. But toning may not be so successful with these materials as the deterioration of the plastic coating on the base sets the life expectancy of such prints.

Bright leaves *Here the uneven fading of the dyes has led to the magenta dyes becoming very prominent*

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Dye permanence

With colour, the problem is that of the dyes fading. The dyes in most colour materials are chromogenic—that is, they are formed during development—and are not completely stable. This is partly because the choice of dyes is often a compromise between a number of considerations, including permanence, purity of colour and ease of formation. With the passage of time, the yellow, magenta and cyan dyes fade at different rates giving not only a loss of density, but also a shift in colour resulting in an overall colour cast.

Dyes for self-developing (instant) and Cibachrome materials are not formed during development, but are present in the material itself. This greater simplicity helps in producing dyes which are more stable.

However, some of these materials have the same problem as normal colour prints in that they use a plastic coated base. This greatly accelerates the processing sequences, but may not be as stable as fibre based materials. Here again, strict and careful processing can help by removing all by-products and the possibility of dye changes due to side reactions.

Image protection

The deterioration of colour prints can be avoided to some extent by reducing the amount of ultraviolet radiation falling on them. A special lacquer is available which absorbs UV and so can extend the life of a print for viewing in sunny conditions. However, glass or plastic covers are often just as good.

Colour slides and transparencies are not so easy to protect. They are, by nature subjected to strong, hot lights in enlargers and projectors, and these can seriously affect the life of an image. But such pieces of equipment can often be fitted with UV filters to help cut down the adverse effects. Also, slides can be duplicated quite easily, and a duplicate used for projection or handling while the precious original stays in archival storage.

In all cases high ambient temperature and humidity have to be avoided as the chemical changes involved speed up under such conditions. Ideal conditions involve a temperature of 21°C or less and a relative humidity of 15 to 40 per cent. Cold storage or even deep freezing of colour dye images helps greatly, but is not necessary for silver images.

For archival storage it is essential to protect the pictures from sulphurous gases, strong light and radiation. One useful method of environmental protection involves using special boxes made from acid-free materials, and storing slides and negatives in sheets made from materials which do not exude traces of chemicals.

In the absence of correct storage facilities, keeping photographs in light tight boxes in cool, dry conditions is a great help. But beginning with correct, careful processing is best of all.

Gardens

Mike Burgess/The Picture Library

Whether you choose the vast expanses of a public park, an elaborate formal garden or your own humble plot, gardens offer fascinating subjects for photography

Gardens are a source of delight to large numbers of people, and gardening is a very popular hobby. The colourful blooms and elegant shrubs in a well kept garden are obvious subjects for photographs. Yet to some they are actually too obvious, and belong to the much-derided 'chocolate box' school.

To dismiss garden photography in this way is unfair. There is a great deal of scope for creative photography in gardens, and if the pictures also turn out to be colourful and pleasing, they have succeeded on several levels.

The range of gardens available for photography is huge, from the humble backyard flower bed to the large scale public gardens or parkland. They can be found wherever you travel, and the national differences in both domestic and large gardens are interesting in their own right. The key feature of all true gardens, as distinct from beds of flowers, is that they have been designed in order to please the eye.

It is probably true to say that many photographs of gardens large and small depend for their effect solely on the ingenuity of the gardener, with little effort on the behalf of the photographer. A garden is a work of art, but it is more complex than, say, a painting. It is a sort of giant living sculpture, which changes from season to season and from day to day. You can walk round it, catch it with unusual lighting, and take photographs which present your own interpretation of it. This is where the creativity of garden photography lies.

As with any subject, however, it is very helpful to understand whatever you are photographing. Although a good photographer could take successful pictures with no prior knowledge, someone who knows what the gardener is aiming at has a head start. With a little background reading, you will be able to identify different types of garden and will find out the essential features of each type.

The aim of any gardener is to create a controlled version of nature. Even the 'wilderness' garden is in a carefully planned style, with trees, shrubs and wild flowers arranged in such a way that they need little weeding or tending other than mowing the grass in places. The garden is designed to appear somewhat mysterious—one is never quite sure what is hidden in its depths—and this is an aspect which your photographs of such a garden should bring out. There is little point in trying to reveal the whole garden at once, by using a wide angle lens, say. Instead, pick out areas which seem to represent the aim well, appearing wild and mysterious.

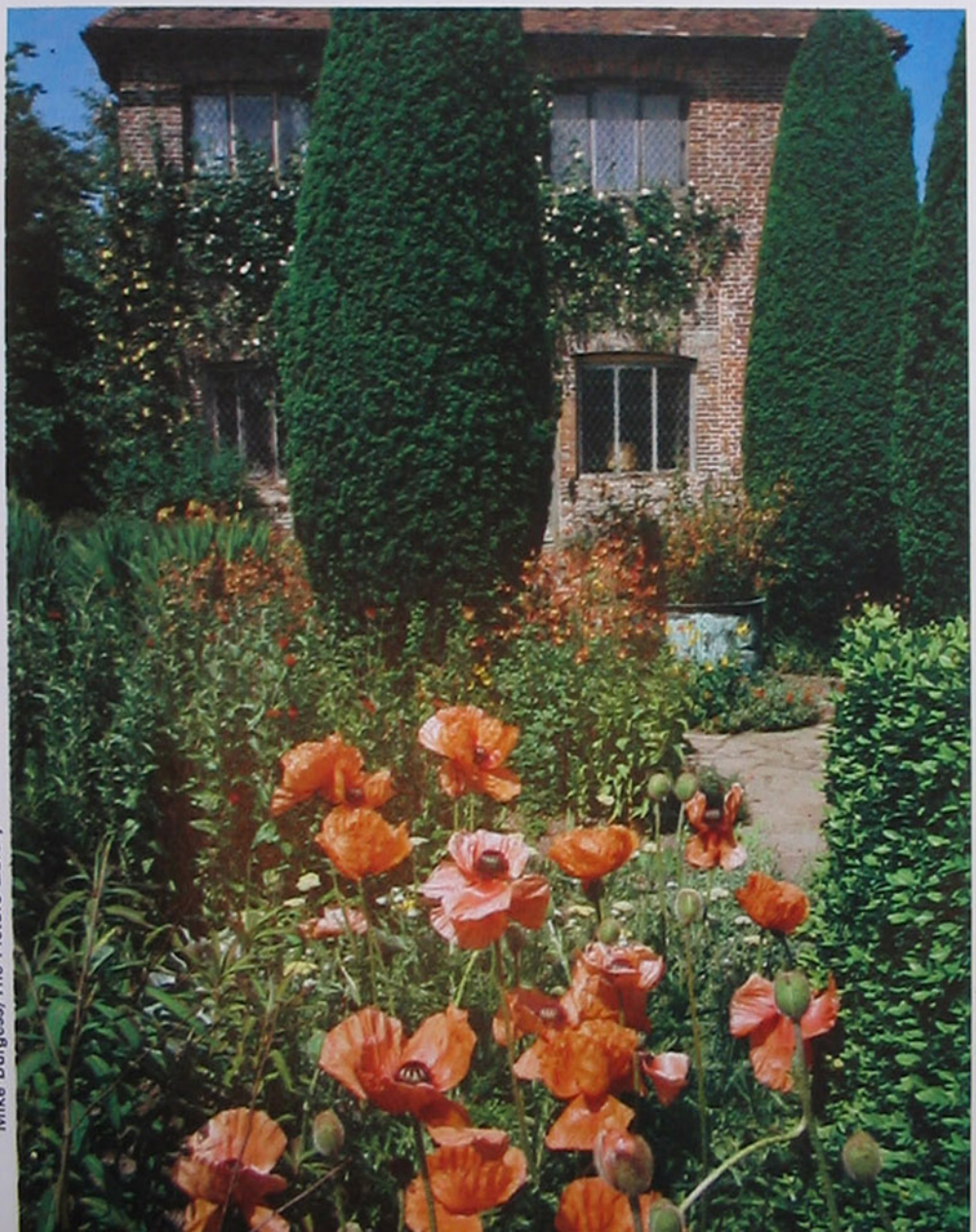
In some ways, the parkland style of landscaped garden, of the sort that surrounds many large country houses, is also a wild garden but on a far larger scale. The aim is different, however—it is planned to offer a variety of prospects, often suddenly coming into view as one travels along a path. Sometimes there are valleys whose sides are covered with variegated trees; sometimes there are distant vistas, with a gap in the trees appearing as if by accident. Often there are buildings, whose purpose you should investigate. Many of these are follies, put there to look picturesque. Others have seats, and are meant to be places where you can stop to admire the view. It would be worth stepping inside such buildings and framing the scene through a doorway or window, if you want to

Blue wall *Strong backgrounds can distract the eye from the flowers, but this one succeeds because it contrasts both colour and texture*

Tokyo gardener *The photographer has posed the figure off centre, allowing us to see the Japanese garden behind*

Poppies *This approach shows both the individual blooms and the style of the garden at Sissinghurst, Kent*

Victor Watts



Mike Burgess/The Picture Library

show the way in which the landscape artist wanted the garden to be seen. On the other hand, the follies are objects to be photographed, rather than photographed from. They are often somewhat overgrown, and allow potential for interesting detail shots.

Another type of garden, often to be found as part of a large landscaped garden, is what is called a 'Japanese' or a water garden. This again is small in scale, and aims to represent a different type of natural setting, representing in real life the idealized views seen in Japanese art. The key features are flowering cherry trees, water and rustic bridges or smaller stone decorations. The whole garden might appear very jumbled in a picture, so it is best to isolate an arrangement of a few key features, and to treat this as a large scale still life. By using a wide aperture and shooting against the light, you could isolate your key features against a misty, dreamy background.

Some gardens are even more obviously manmade, with no pretence to naturalness. The formal garden, with neat beds which themselves make patterns, is an example. These gardens may contain no flowers at all—the patterns are formed by shrubs, or by coloured pebbles. Some gardens even have beds of decorative vegetables.

Such a garden is very strongly symmetrical, and indeed is a good example of a subject which can be successfully photographed in a symmetrical way, possibly using a wide angle lens. Urns or statues frequently feature in such gardens, their function being to arrest the eye and provide

points of interest. Your picture can use them in the same way, as an essential part of the scene but not the main feature. A wide angle lens and a viewpoint near the ornament often give interesting results.

The formal garden can also be photographed from the house which it surrounds, possibly from an upper room from which the patterns will become more evident, as they were intended to. Many other types of garden will appear much less satisfactory from such a viewpoint, unless you isolate interesting details using a telephoto lens.

Different parts of the world have their own distinctive garden styles. England is well known for the 'cottage garden', very small but crowded with blooms on either side of the path. In such a garden the cottage itself is an integral part of the scene, as is the owner of the garden itself. Another regional variant, completely different in style, is to be found around the Mediterranean and in other regions with a similar climate, such as California. Brilliantly coloured flowers are prominent, but the garden is viewed from the shade of covered walkways. These shady areas are again as much a feature of the garden as the flowers.

The domestic garden is often not designed or landscaped, but for many people it is the most accessible kind. A garden is a miniature countryside with its own selection of flora and fauna. The largest wild animal may be a hedgehog or a fox, but if you have a garden you can spend much longer in exploring the various possibilities than you could elsewhere. You can photograph it throughout the year, and in all types of weather. The smaller the garden, the more detailed your photographs will probably be, but even a window box will allow you some scope for pictures.

The straightforward approach to photographing a garden is not always the most creative. In general, photographs which are in some way out of the ordinary succeed because of either a novel viewpoint, unusual lighting, or a selective composition.

The viewpoint from which a garden is meant to be seen is eye level. It may therefore not always be appropriate to choose an odd angle or extreme lens, though both these approaches can be successful in particular circumstances. You can transform a garden in such ways—plant stems can turn into a forest of tree trunks, or flowers can loom threateningly over the photographer with a wide angle lens.

Unusual lighting or weather conditions can also transform a garden. While gardens usually look their best when in brilliant sunlight, misty or showery weather can provide equally interesting pictures. A shower of rain followed by a bright interval is a time of feverish activity for the creative photographer, who must record the raindrops on the blooms against a backdrop of grey clouds as soon as possible before they dry out in the wind.

Cecil Jospe

Chair *A simple detail can make an effective picture, especially when the subject has a distinctive shape that stands out well against the foliage*

It is even possible to take garden pictures at night, using a portable flash gun to illuminate selected parts of the scene in an often eerie way. The flowers will stand out brilliantly against the black background.

When walking around a garden looking for pictures, the technique of selecting a small part of the scene is invaluable. Try to identify the essential features of the garden—the subtly contrasting greens of the shrubs, or the way a herbaceous border blends with the ancient wall behind it, for example. Even a very long focus lens can be useful for selecting one particular bloom against a background of others.

There are few special techniques needed when photographing a garden. The choice of lens and viewpoint is not critical, but it is important to make sure that individual blooms are either quite clearly visible, or are a general part of the scene. Medium distance shots frequently fail because they depend for their effect on the individual blooms, which become lost against the background of foliage. This effect is more disturbing if you usually have machine made prints, rather than hand prints or transparencies.

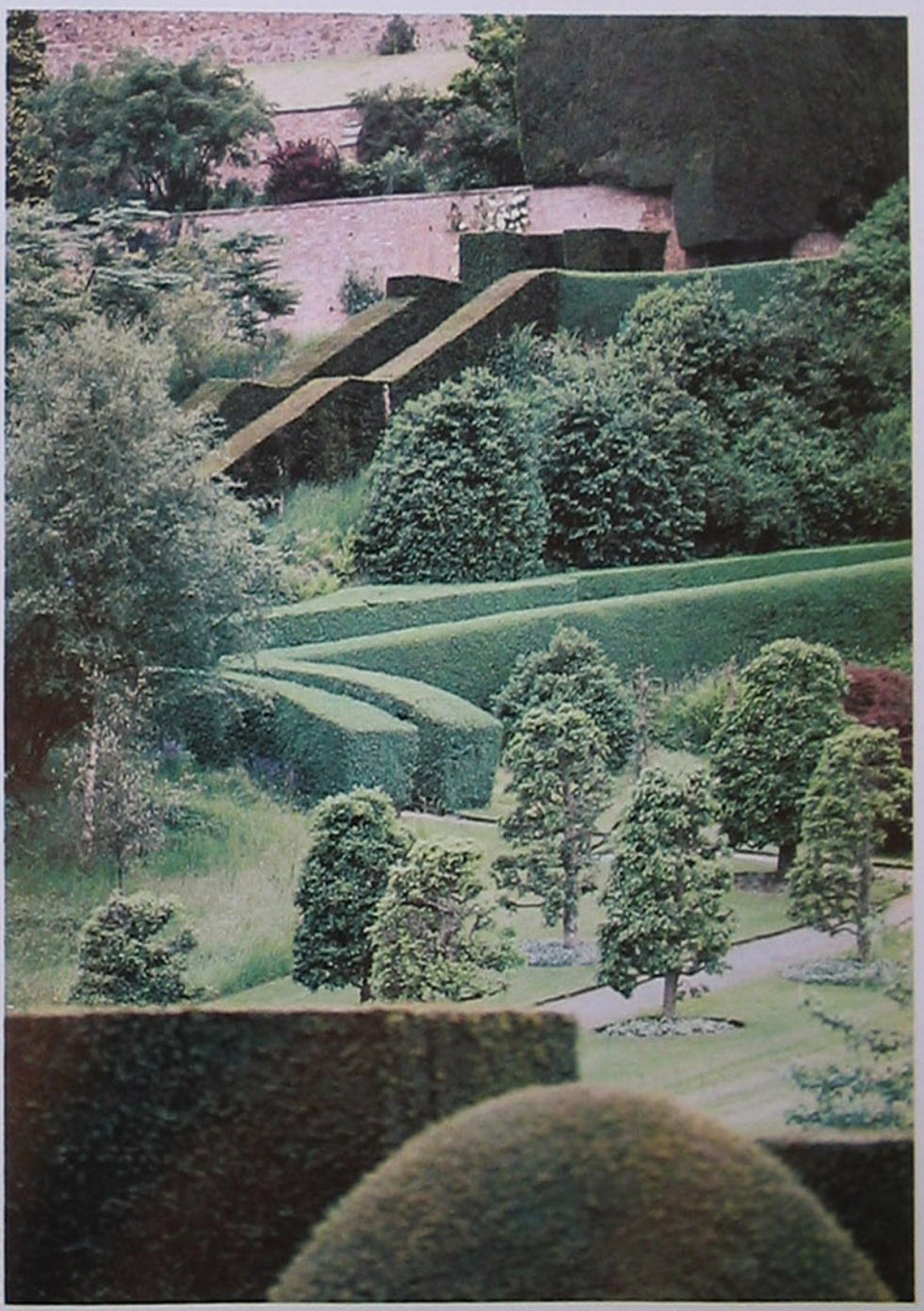
The bane of the garden photographer's life is the wind, which blows the flowers and makes it impossible to use the long exposure times that result from the small apertures that are needed for good depth of field. A tripod is of some use, as it helps you to get the composition exactly right and cuts down camera movement, leaving the wind alone to provide movement in the image.

Linda Burgess/The Picture Library

Elizabethan garden *A formal garden often needs a very carefully composed shot to do justice to its geometrical layout and precise balance of colours*

Red tiles *Even if your garden consists of boxes of plants, an unusual angle can make the most of its modest size*

Hedges and trees *A telephoto lens can sometimes be used to condense various elements, bringing them all effectively together into one shot*



John Sims

Some formal gardens prohibit the use of tripods, and their owners or keepers will forbid you to take photographs if you carry one. It is a good idea to find out whether there are any such restrictions before you visit a large garden. In the case of privately owned gardens, it is a matter of courtesy to ask the owner's permission before taking pictures in any case, even if there is an entrance fee. It is always a good idea to be on good terms with the owner or the garden staff, as they will often be able to give you inside information, or tell you the best time to see particular plants in bloom. It may well be worth a return visit if you are keen to catch the garden at its best. Usually, however, people are so proud of their gardens that they are quite happy to let you take photographs, especially if they are included in your shots.

In many ways, the amateur garden photographer has many advantages over the professional. The professional's job is to take commercial pictures, which are often not the most creative. And as soon as some authorities learn that someone intends to sell their pictures, they will forbid any further photography. It is better to make it clear that your pictures are for your own personal pleasure only —and in that way, you may well be able to obtain photographs which will rival any you may see in glossy gardening books or magazines.

Tania Midgley/Vision International

Cecil Jospe

George Wright

Dmitri Kasterine/Daily Telegraph Colour Library

Equipment file

Lenses for enlargers

Dave King/equipment courtesy of Bush & Meissner and Nikon

Many enlargers have a rather poor standard lens or are supplied without one at all. Choosing a high quality lens enables you to make the best prints with your equipment

Enlarging lenses are like speakers in hi-fi systems—their quality affects the final performance of everything else. Even if you have the finest turntable and amplifier, your records inevitably sound bad if you have poor speakers. Similarly, an enlarging lens is the final stage in the path between your subject and the print, and the quality of the image you eventually print on paper depends on every step of the process.

A good enlarging lens is essential if you are to get the best possible results from your equipment. But no matter how good the enlarging lens is, it cannot make crisp prints from poor negatives. An imperfect negative taken with an indifferent camera lens will be rendered even worse in the printing if a cheap enlarging lens is used, while a good camera lens virtually demands the back up of a good enlarging lens.

General features

As with other photographic lenses, the initial feature you should consider in an enlarging lens is its focal length. This determines how large a print you can make without having to resort to special techniques, and also the size of the negative that can be printed. As a typical example, consider what happens when you make a 29 × 43 cm print from a 35 mm negative—about 12 × magnification. With a 50 mm enlarging lens this size print calls for a negative to baseboard distance of about 70 cm. With an 80 mm lens, the necessary distance is 112 cm, which may well be longer than the column of your enlarger.

It might, therefore, seem desirable to use as short a focal length lens as possible for making enlargements, but in practice there are limits. Just like other lenses, enlarging lenses have a circular field and the negative you are enlarging must fit within this field. The diameter of the circle must be greater than the length of the negative diagonal. Usually this means that the enlarger focal length should be about the same as the focal length of the standard lens for the format you are using—a 35 mm camera negative calls for a 50 mm lens, a 6 × 6 cm negative calls for an 80 mm lens, and so on. But as long as the lens can cover the whole of the negative you are printing, there is no reason why you should not use another focal length lens. Thus an 80 mm lens easily covers a 35 mm negative, while a 50 mm lens is quite capable of enlarging 110 negatives.

Another factor influencing your choice of focal length is the optimum designed magnification. A 6 × 6 cm negative does not need to be enlarged as much as a 35 mm negative to give a good sized print, so lenses made for the larger negative size are designed to give their best performance at a somewhat lower magnification than those for 35 mm. The practical differences are usually very slight, and are only likely to be noticed in the most critical applications.

Maximum aperture is less important with enlarger lenses than with camera lenses. The main advantage of a relatively fast *f*/2.8 enlarging lens is that its shallower depth of field and the brighter image it gives at full aperture make focusing easier. Regardless of their maximum aperture, most enlarging lenses need to be stopped down to about *f*/5.6 before they give their best performance, although some expensive high speed lenses give good performance at their maximum aperture.

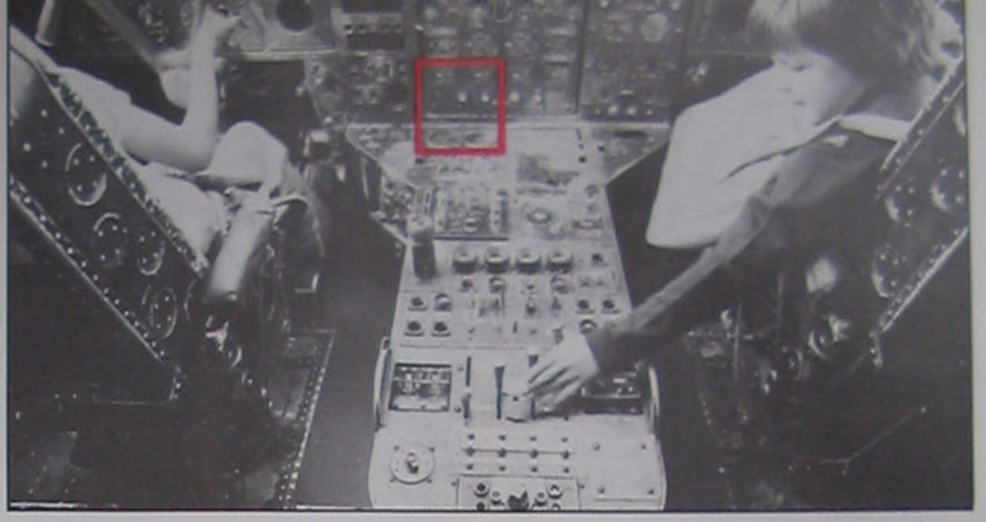
Some photographers used to argue that the lens that took a picture was the ideal one to make an enlargement, as the light rays from the negative would travel in reverse through the lens to the paper. Indeed, most enlarger lenses still have a standard screw thread mount that is the same as that used on early Leica camera lenses. The main flaw in this theory is that the distance from the lens to the print is usually much smaller than that from the lens to the original subject.

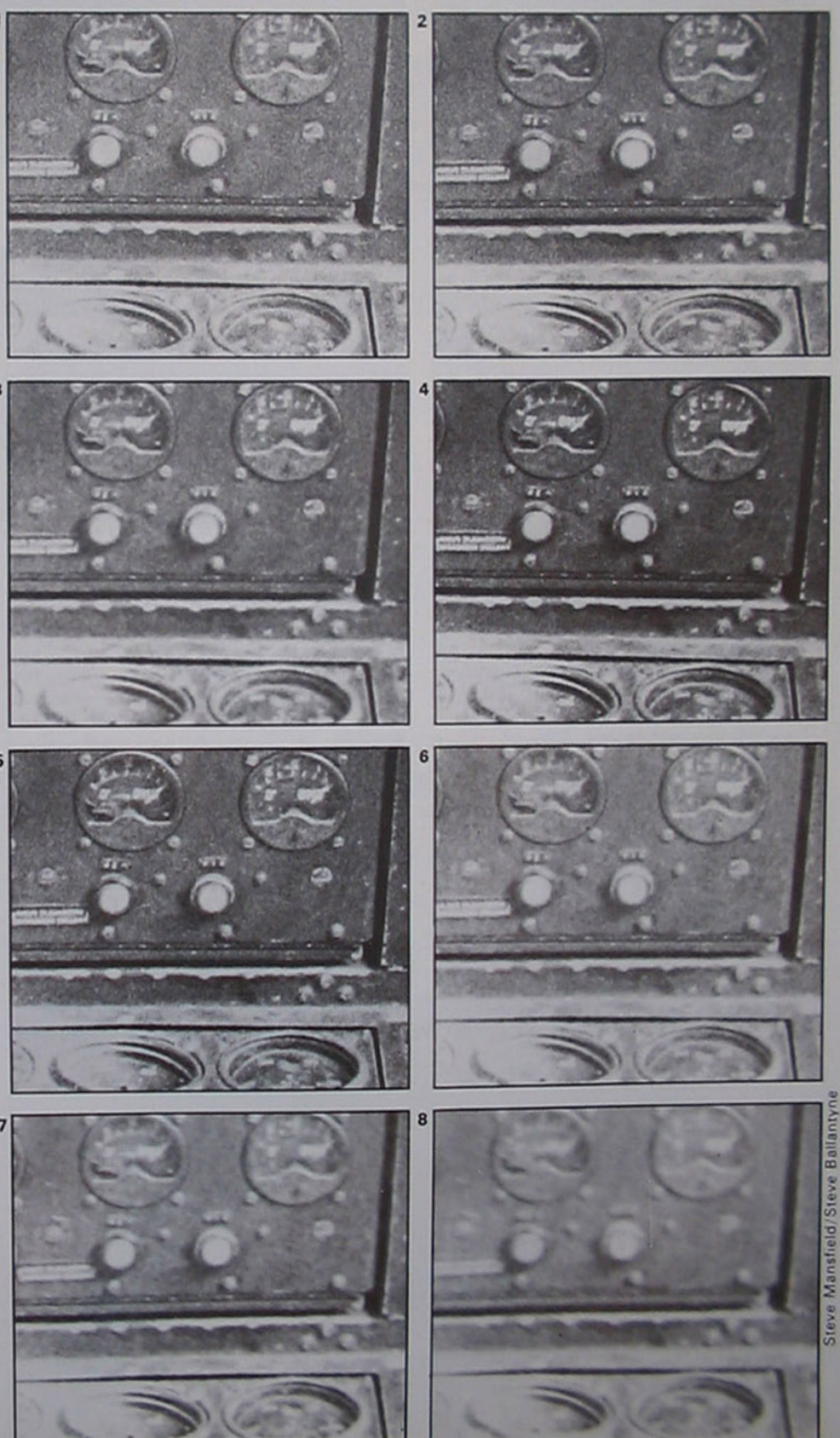
Since camera lenses are usually optimized to perform at their best with subjects at a great distance, the results are not as good as those given by proper enlarging lenses. Additionally enlarger lenses are assembled with special heat resistant cement. The heat produced by some enlargers can be strong enough to damage the cement used to hold camera lens elements together, so if you come across a cheap old screw-thread camera lens, do not be tempted to buy it for enlarging use. A few enlarger lenses, notably some made by Schneider, have a screw thread that differs from the Leica standard. In such cases you may need to buy an adapter ring to fit your lens to your enlarger.

Since enlarging lenses have to be used in low light or total darkness, many manufacturers now include means of illuminating the numbers on the *f*-stop scale. Usually this is done by building a small window into the rear of the lens to divert light from the enlarger to the *f*-stop scale. Sometimes, however, illuminated *f*-numbers are not much use: lenses may need to be mounted on recessed lens panels with some enlargers, particularly those that are designed to be used with both roll film and 35 mm negatives, and as a result the aperture ring cannot be seen. In such cases it is important for the aperture ring to have clearly distinguishable click stops, so that the correct aperture can be found by counting clicks. Some lenses allow you to override the click stop mechanism, to give a continuous variation of aperture. This is a useful feature when assessing exposure with an enlarging meter or a colour analyzer.

Special features

Since it is useful to have a short focal length lens for making big enlargements, some manufacturers produce wide angle enlarging lenses with an unusually large field relative to their focal length. It is difficult to make shorter focal length lenses with the properties needed for enlarging, so the difference in focal length is not usually very startling—a typical wide angle enlarging lens for 35 mm negatives has a focal length of 40 mm instead of 50 mm. Nevertheless, this small difference is sufficient to let





Steve Mansfield/Steve Ballantyne

Lens test *Selective enlargements were taken from a test image (top) using a cheap lens (right hand column) and a lens costing five times as much (left hand column). Pictures 1, 2, 3 and 4 are enlargements with the image at the centre of the lens. Stopped down (1 and 2), the resulting difference is minimal. Fully open, the slower cheap lens actually gives better definition. Pictures 5, 6, 7 and 8 are enlargements with the image at the edge of the lens. Here the expensive lens gives better results than the cheap one, both stopped down (5 and 6) and opened up (7 and 8). In fact, the expensive lens is consistently good at the edge of the lens at all apertures while the cheap lens is consistently bad*

you make 30 per cent greater enlargements at the same negative to baseboard distance. The main disadvantages are greater expense, and incompatibility with some types of enlarger illumination. These lenses generally need to be used with diffuser enlargers; condenser enlargers usually give uneven illumination with shorter than normal lenses. (See pages 282 to 285.)

Zoom enlarging lenses are a further refinement. The advantage of such a lens is that it does away with the need for constant focusing. Once it is focused for a range of print sizes, changes are made simply by turning the zoom ring. Zoom enlarging lenses were originally designed for commercial printing machines, and are complex and expensive, and not often available. They do not usually match the quality of good fixed focal length lenses.

Other special lenses have been produced, including lenses with built-in filters for colour printing—which could unfortunately only be used at full aperture—and lenses with a slot in the side for inserting a colour analyzer or various special effect filters such as graduated or soft focus filters between the lens elements. The Rodenstock Rogonar-SC is of this type.

Potential faults

An enlarging lens must have certain special properties. It must have a very flat field and be corrected for work at short distances. There should be no distortion. Even cheap enlarging lenses usually manage to meet these requirements. The faults that are more often found in poor lenses include focus shifting when the lens is stopped down, vignetting, poor colour correction, and lack of sharpness.

Vignetting can be a more serious problem. A lens with this fault gives the corners and edges of the image less exposure than the centre. When printing negatives this may not be noticeable, since all camera lenses vignette as well, giving negatives that are thinner at the edges than the centre. However, when making a print from a slide on colour reversal materials, the results can be startlingly bad. Camera lens vignetting, enlarger lens vignetting and the inherently high contrast of most slide printing processes combine to give prints that are disturbingly dark in the corners. Vignetting may be reduced or eliminated by stopping the lens down, but this is not a very good solution if you are making a print on a material with a low printing speed. Exposure times can become unmanageably long, leading to unexpected colour shifts caused by reciprocity failure. This is one of the reasons why colour printing calls for the best enlarging lenses.

If you only intend to make black and white prints it is not necessary for your enlarging lens to bring light of different colours to precisely the same point of focus, since black and white paper is only sensitive to blue light. Most modern enlarging lenses manage to focus colours together well enough to make colour prints without any noticeable fringing, but older lenses with simpler designs may not be suitable for colour printing. The most extreme attempt to counter colour fringing was probably the apochromatic enlarging lens made by Nikon. This lens brought three different wavelengths of light to precisely the same focus, had a focal length of 105 mm but only enough coverage for a 35 mm negative, and was astonishingly expensive.

The most obvious fault of a poor enlarging lens is lack of sharpness. The lenses you use to enlarge your negatives should ideally be able to resolve the grain structure that makes up the image. This level of resolution needs to be maintained evenly over the entire field of the lens. If your present enlarger lens produces prints from 400 ASA black and white film that are crisp in the centre but have smeared-out grains at the edges, then your lens is not good enough.

Apparent sharpness has two components—resolution and contrast (see page 1100). Unfortunately, the two properties tend in practice to exclude each other—lens manufacturers find they can increase the resolution of their products only at the expense of some loss of contrast, and vice versa. Different manufacturers settle on different working compromises for their lenses.

Finding the right lens

Most photographers use the lens that is fitted to their enlarger when they buy it. Often this is not a good policy. Manufacturers attempting to keep the prices of their enlargers at a competitive level often make severe compromises, and fit indifferent lenses to their equipment. It is better to buy an enlarger with no lens and select a lens to fit your needs.

As a rule, you should always buy the best lens that you can afford: compared to camera lenses, this is not necessarily a major hardship. Enlarging lenses do not have the focusing and automatic diaphragm mechanisms that increase the complexity and cost of camera lenses, so when you pay a substantial sum for a good enlarging lens, you are paying mostly for very high quality glass.

You should match the lens you buy to your format needs. If you use both 35 mm and roll film, you may find it better to choose a longer focal length lens to start with. Some photographers argue that when a 35 mm negative is enlarged with a lens designed for 6×6 cm film, sharpness is better because only the centre of the lens field is used, where image contrast and resolution are at their highest. In recognition of this belief, a few lens makers produce lenses for enlarging 35 mm negatives with longer than normal focal lengths and good coverage. These lenses usually have focal lengths around 60 mm, and are made to perform best at the magnifications most often needed for 35 mm negatives.

Enlarging lenses are very durable, so you should consider your purchase in the light of your probable future needs. If you think there is little chance that you are going to attempt colour printing in the future, then you may not need an *f*/2.8 lens. If you think you may want to make very large prints, then a wide angle lens is a sensible choice. The lens you buy will probably last a lifetime, so think carefully before you decide.

Dave King/lenses courtesy of De Vere & Schneider

Zoom lens *The Schneider zoom enlarging lens is much larger and heavier than a normal enlarging lens*

Dave King/lenses courtesy of Nikon

Three lenses *Though they look the same, these 50, 80 and 105 mm lenses have different sized end elements*

What went wrong?

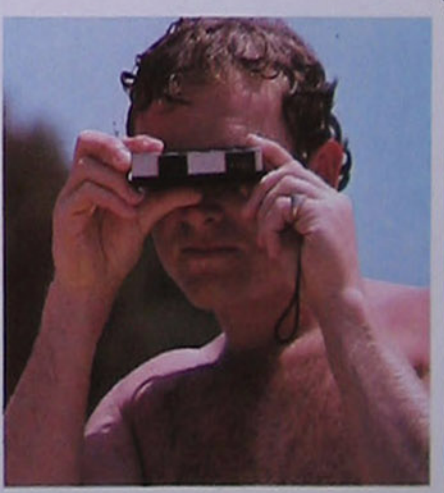
Common errors with 110s

Not even a sophisticated 110 camera will give good pictures if used badly or beyond its capabilities—small cameras often mean big problems

Poor framing is a common fault with 110 shots because the distance between the viewfinder and the lens causes parallax error. This is particularly acute when the subject is close to the camera (top picture). On many sophisticated 110s, the brightline frame guides in the viewfinder move automatically to correct parallax, but with simpler cameras the brightline is fixed and you must take care to use the parallax guide marks for close-ups. Alternatively, move back to reduce the chances of parallax error and to ensure that all the subject is framed even when it does occur (above). Beware of unwanted foreground appearing in the frame through parallax error when shooting in crowds or in other confined situations, such as at zoos (below)

Few flashguns on 110 cameras are capable of properly illuminating a subject more than five metres away, and many long distance flash shots are distinctly underexposed (left). However, even close shots with flash can be underexposed if you allow a finger to stray in front of the flashgun during exposure (right)—or over the lens! Beware also of stray camera straps and other obstructions

On the simplest 110s, you cannot always vary the exposure to suit the lighting, so you may have problems with contrasty subjects (left), particularly with slide film. Even in sunny conditions, pictures which include large shadow areas (right) often appear underexposed—though the bright areas have the correct exposure. In these circumstances, use the cloudy setting for a brighter picture



Beware of setting too small an aperture on semi-automatic 110s, because the exposure system will give a slow shutter speed and any camera shake will be obvious (left). The effects of camera shake at slow shutter speeds can be minimized by holding the camera firmly, with both elbows tucked in (right), and pressing the shutter button smoothly—stabbing at the shutter button may jog the camera

David Burnett/Contact/Colorific

World of photography

David Burnett

Arizona cattle drive *This shot of Ed Overmeyer was taken during a month long personal story on cowboys in 1975. It later sold world-wide*

David Burnett *festooned with cameras and lenses on assignment in America*

Rick Smolan/Contact/Colorific

For his brilliant coverage of some of the world's most difficult news stories, David Burnett has been awarded some of the most prestigious prizes in photojournalism

In photojournalism there are no second chances—if the photographer misses the vital moment, the picture is gone forever. A successful photojournalist must be in the right place at the right time and often this is the hardest part of the job. It is something that David Burnett seems to do remarkably well.

Keen to be on the spot at the right time, Burnett travels practically non-stop and spends about nine months of every year away from his home base in New York. A good deal of this time is spent in countries that are undergoing some type of political upheaval. Like most photojournalists, Burnett enjoys the feeling of being on the 'edge' that working in such a situation gives him. He has photographed, among other events, the Vietnam War, the right-wing coup in Chile and the uprisings in Iran.

Although only in his 30s, Burnett's talent for 'being there' has earned him some of the top awards for achievement in photojournalism. These include the Robert Capa, Page One and Overseas Press Club awards, as well as the World Press Photo Contest.

One of the stories for which Burnett is best known is his coverage of the uprisings in Iran, where his talents were stretched to the limit. He found himself working in an extremely volatile situation and did not know the culture or the language. As an American journalist, Burnett was in a particularly awkward position since many Iranians disliked the foreign press and especially Americans.

Fortunately Burnett speaks good French so he managed to persuade most

people that he was a French photojournalist. Even so, he often found himself in some of the most trying physical circumstances he had ever worked in.

'There were times when I would be in the middle of a crowd of a million people —I had a couple of bad experiences, mostly a question of jostling. A number of times people got angry at the cameras. I would try and hastily cover the situation around me, but sometimes the atmosphere would get so intense that I just had to retreat. It was a matter of knowing when I could actually take out the cameras and work and when it was just not safe to do that'.

Often the problems were not just covering events, but finding out which events to cover. In the extremely charged atmosphere of the time, it was difficult to tell what was going to happen next. Both the political situation and everyday events changed constantly.

'It was obvious that there really was a major event brewing around you. You could feel a lot of the basic issues very early on. But there was also an element of doubt about what was happening partly because of the language problem. So you had to make up for this by being extra sharp'.

Burnett and his fellow photographers also found that they could easily be distracted from following the main course of events by the dramatic street confrontations that erupted everywhere.

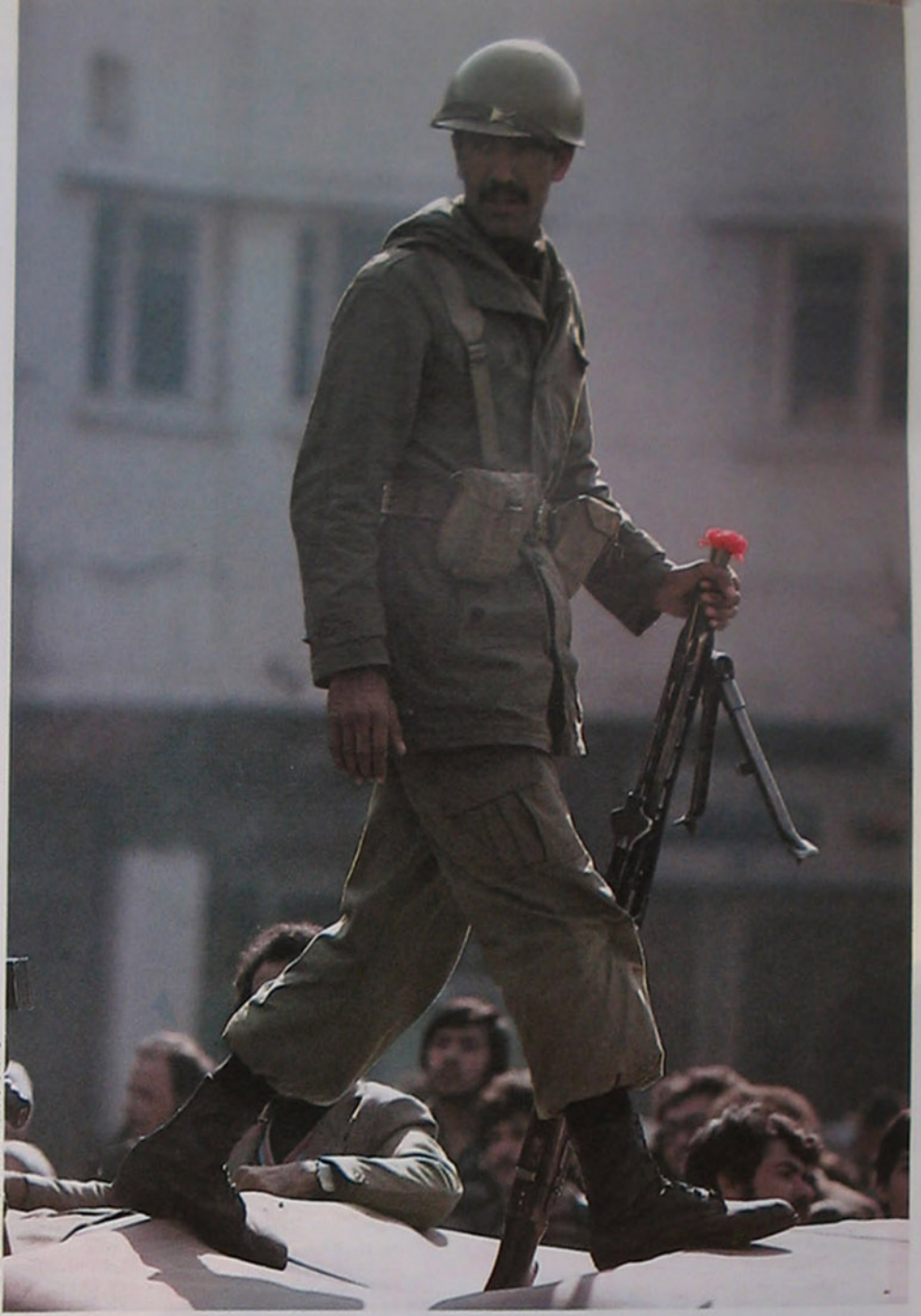
'You have to be very tough with yourself to maintain some kind of continuity with your story. This is very hard to control, because the situation changes every day. You can't really know what's going on. It happens when it happens, and you're lucky if you're there when it does.'

Nevertheless it is clear that Burnett does seem to have developed a kind of sixth sense for a story, as his pictures clearly demonstrate. He is also adept at bringing back the kind of all-round coverage that such magazines as *Time*, *Newsweek*, *Life* and *GEO* require.

Burnett's interest in photographing news events started very early on. Although, at 16, his first pictures were for his class year book at school, he was soon covering news events for several local newspapers.

As he says, 'I was taking pictures all the time. It was obviously all I wanted to do'. As a result he started taking photographs for a living as soon as he completed his degree course in political science. It was then, at the early age of 20, that Burnett was given a contract by *Time* magazine. He continued working for *Time*, first in Washington and then in Miami, for two years.

This was at a time when the American involvement in the Vietnam War was becoming increasingly contentious and Burnett was bored with being a 'stringer' and only taking pictures of local events. The challenge of the war zone was irresistible and in 1970 he left to spend six months in Vietnam. In fact he stayed for two years.



David Burnett/Contact/Colorific

Sign of change *An Iranian soldier carrying a red carnation—a symbol of the uprising—in his gun barrel*

The Vietnam experience was invaluable. Burnett learned that doing a long-term story was very different to the odd one or two day shoots he had been doing. As a freelance in Vietnam he had to decide himself what stories to cover and establish his own approach. A fierce war was hardly an easy place to learn these disciplines.

While in Vietnam, he also had to teach himself to write well. As he says, he was a photographer but not much of a writer when he went out. By the time of the American withdrawal in 1972 he was a recognized journalist. He was also one of the main freelance photographers for both *Time* and *Life*.

On his return to the United States, Burnett was under contract to *Life* magazine. It was then the dream of every young photojournalist to work for *Life* and he felt he was on the road to success. Only one month later, *Life* closed down. Burnett was in despair. Having achieved his aim, he felt suddenly abandoned.

He then travelled for about six months before joining his first agency Gamma—the largest photographers' agency in the world and famous for its saturation coverage of 'hard news'. Burnett enjoyed working for Gamma for a while. 'It was with Gamma that I really started to develop. Looking back I feel a lot of gratitude for the editors who hired me. I don't know if I would have hired me if I'd been the editor. It's good—you need editors that give kids a break'.

Gradually, though, he became disenchanted with having to work for such a large agency. Also the agency was geared to handling 'hard news' while Burnett was becoming more interested in doing longer stories.

In 1975 he joined the ex-New York Gamma chief Robert Pledge and news photographer Eddie Adams and set up their own agency—Contact. They

wanted to create a small collective of accomplished photographers that did not have the impersonal atmosphere of the larger agencies. They also wanted to aim more at the magazine market working on more in-depth reports.

Although Burnett still likes to spend a large part of his time on 'hard news' stories, he now tends to do more editorial work than before. Most of this will be assigned to him by magazines—sometimes from ideas that he or Contact suggests and sometimes assigned by the magazine's editor. The briefs for these vary widely. 'The best situation is when the editors have a very specific idea but you don't think it's so great. So you

Cockfight *Shot for a story on the Philippines in June 1978 for the first US issue of 'GEO'*
Seoul workman *A fine portrait taken for a 'Time' story on Korea*
Riots in Iran *General Latifi being dragged from his car at a tense moment in Burnett's two month stay*

David Burnett/Contact/Colorific

David Burnett/Contact/Colorific

Khomeini's return, 1979 *The ayatollah surrounded by acolytes soon after his return to Iran from exile in France*

Waiting for peace *This picture of a Kampuchean refugee at Sa Keo camp in Thailand won several major awards*

shoot it both ways—your way and their way—and they end up using your idea. That's very gratifying because you've been able to take a basic idea and expand on it in the way you see it'. He adds that if you do this enough times, the editors will keep calling back—for the little extra that an inventive photographer has been able to give.

Burnett works a heavy schedule. He may spend anything from a few days to a few weeks in a constant succession of countries. In spite of this extensive travelling, or rather because of it, Burnett takes almost everything with him but clothes. 'What I now realize is that I don't need many clothes to work. The amount of clothes in my suitcase gets smaller and smaller—the rest is film.'

He also takes four or five camera bodies—two Canon A1s and two AE1s with motor drives and autowinders—and all the lenses from 20 mm to 600 mm, including 35-70 mm and 80-200 mm zooms. He may not carry these around with him all the time but he likes to have them in case of breakages.

When he went to Burma, he took the barest minimum of equipment—two cameras and the 28, 50, 85 and 200 mm lenses with a 2 × converter and a meter. He worked in colour then, but would have added another camera body if he had also been working in black and white. Burnett considers a light meter indispensable. He has three—a Minolta Auto Pro, a one degree Pentax spotmeter and a Minolta flash meter—an incident meter which he sometimes uses as a standard meter. He always carries at least one of these with him.

Burnett has never been very attracted to commercial work. Even so there are some kinds of advertising more suited to an editorial approach which he would like to do if given sufficient artistic freedom. Generally though he does not do commercial work to finance personal projects. 'I don't work that way. My editorial work pays for my editorial work and that's it'.

One of the personal projects that Burnett is doing is a portrait of the Mormons—a large religious group based in Utah. This is a long-term project which he works on 'in bits and pieces'. On personal projects Burnett will pay for his own film and expenses and develop the story himself.

He is also doing a personal story on minor league baseball—a reaction to the domination of 'big-time sports'. He chose a small team and spent a lot of time travelling around with them to games and following all their activities. 'You always have a few days of them getting used to you and your cameras, but after a while they just don't care anymore. That's when the pictures start to come'.

As in his 'hard news' stories, being in the right place at the right time is crucial, but here Burnett's approach is different. He involves himself far more deeply in the story and in portraying different aspects of his subject.

Burnett's personal projects are also approached at a more leisurely pace. He finds them a pleasant counterbalance to his usual assignments. For even after spending over fifteen years as a world-class photojournalist and winning a galaxy of awards, Burnett still gets a knot in his stomach every time he starts an assignment. This is partly from the simple excitement of being part of an historic event but also from knowing that whatever happens, he will only have one chance to get the picture—any mistakes mean the picture is lost.

'You seldom know while you're shooting something whether or not you have a good picture. It's for better or worse until I get the film back. But that doesn't make it any less exciting'.

Burnett does not plan very far in advance now. With his network of contacts already established and his style of working and reputation for getting the pictures already confirmed, he just waits for things to come along and fall into place. 'I'm pretty lucky,' he says modestly. 'I keep running into interesting things.'

Equipment file

Movie projectors

Before choosing a movie projector it helps to know exactly what the different types can do so that you can find one to match your needs

While the range of movie projectors on the market is not nearly as large as that of 35 mm SLRs, the amateur may still be baffled by the variety of projectors and by the terminology used to describe them. Movie projectors range in sophistication from the very simple silent type—excellent for showing films of the annual holiday, or baby growing—to those with full stereophonic hi-fidelity sound reproduction and near professional presentation.

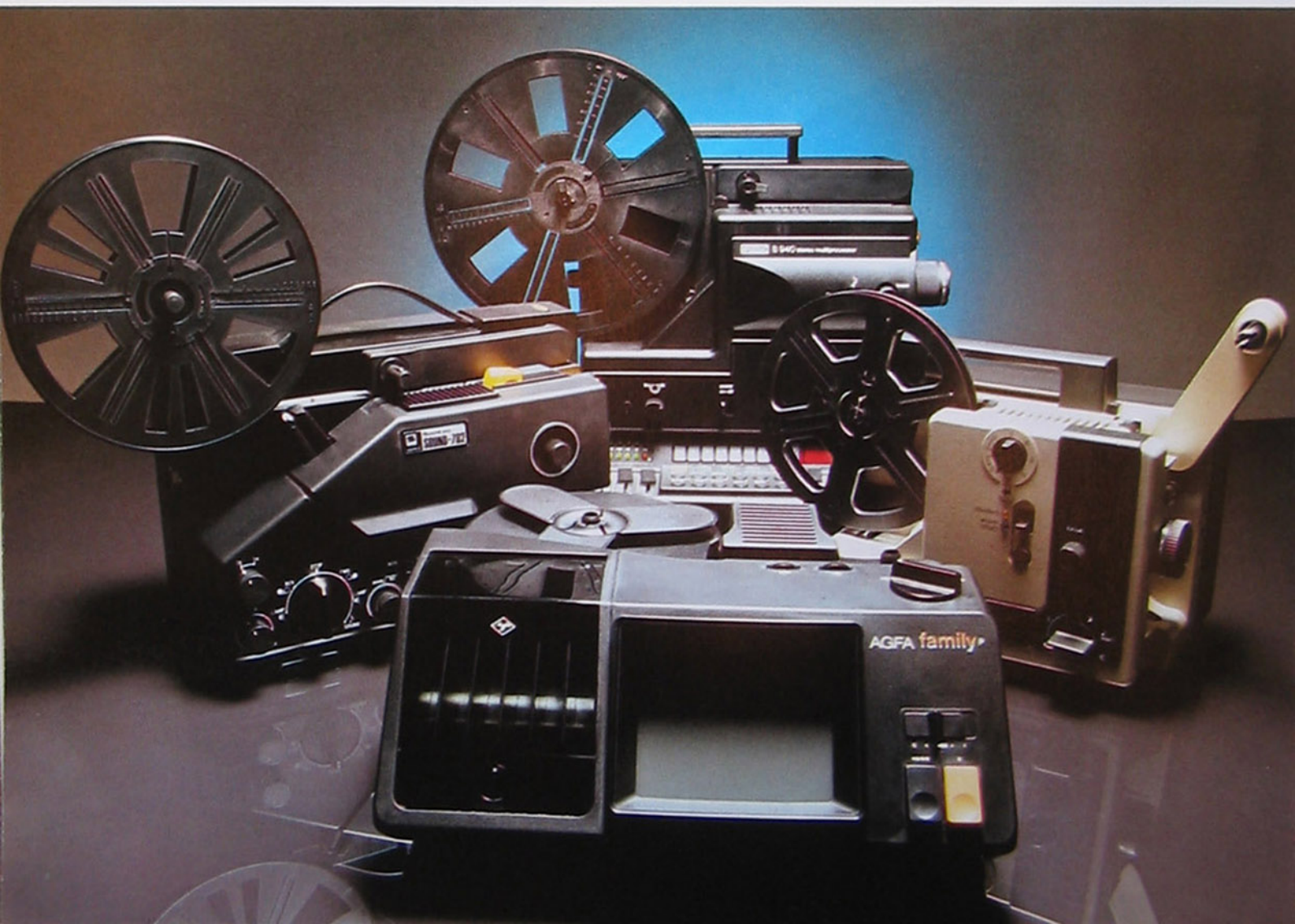
Before deciding which projector to buy, it is well worth familiarizing yourself with the main features of each type to see how they fit in with the sort of filming that you want to do and the type of movie shows that you want to present.

The majority of modern movie projectors designed for amateurs take 8 mm film, the most popular being *Super 8*, a film introduced by Kodak in 1965. Fuji produce a film called *Single 8* for use in their movie cameras. This is essentially the same as Super 8 and can be safely used in all Super 8 projectors, though the film cartridges for use in the camera are not compatible. *Standard 8*, the original 8 mm film, is now obsolescent. If you are using a Standard 8 camera or have reels of old Standard 8 film that you want to project, it is probably worth considering a dual gauge projector. These can handle both formats and will enable you to switch from Standard 8 to Super 8 in the future without having to buy a new projector.

Until recently, threading the film through the projector gate was a fiddly and irritating task demanding infinite patience. Nowadays, virtually all Super 8 projectors are designed with automatic threading. The film leader is simply inserted into the entrance guide

Michael Newton/equipment courtesy of Eumig

Projector variety *The more sophisticated the projector, the more bulky it becomes. The little silent projector (below right) is much more portable than the stereo model behind it*



and the projector mechanism does the rest, taking the film through the gate and on to the take up spool. Some projectors have a removable side cover so that you can check that the film is threaded correctly. It also enables you to change films halfway through a show without having to run the film all the way through to the end of the reel. The removable cover also makes it simpler to clean the projector and free jammed film.

More sophisticated projectors have an automatic system which switches the projector off when the film runs out. This is especially useful if you are conducting a film show with the projector in another room. It saves you running around when the film show comes to an end or the reels need changing.

Film transport

The projector's film transport system is designed to carry out two operations. It must draw the film through the projector continuously, while at the same time producing an intermittent movement so that each frame of film is held in the gate while the image is projected.

Loops of film above and below the gate smooth out the intermittent motion so that the film runs at an even rate, apart from through the gate itself. On sound projectors, a flywheel or a separate motor is used to maintain a constant speed of the film across the magnetic sound head.

In nearly all non-dual gauge projectors continuous drive is achieved using toothed wheels called sprockets which engage in a set of perforations running down one side of the film. Because Standard 8 and Super 8 films have different sized perforations, dual gauge projectors are usually sprocketless, the film being driven by rollers.

The intermittent movement of the film through the gate is achieved by means of a claw mechanism which engages in the perforations and pulls the film down one frame at a time. Some projectors are fitted with a double claw. This has the advantage that far less stress is exerted on each perforation, reducing the possibility of tearing.

When you are choosing a projector, ask to see it in action, so that you can examine the intermittent mechanism carefully. If the screen picture is unsteady, the fault could lie in the projector. Another common problem is *breathing*, where the image and the frame line pulse in and out of focus. This is a symptom of a fault in the gate pressure system.

Generally, only silent movie projectors offer a wide range of running speeds. Some have a set of preselected speeds such as 3, 6, 9, 12, or 18 frames per second (fps). If you have filmed at 18 fps, the standard speed for most amateur movie cameras, such projectors can be used for slow motion replay—both for artistic effect and for amusement. Other projectors have a continuously variable speed control for replay of between, say, 14 and 22 fps.

For frame by frame analysis, there are projectors which can be held on a single frame for some length of time, without heat stress on the film. Some allow you to advance one frame at a time by using a single shot button, a facility sometimes called *inching*.

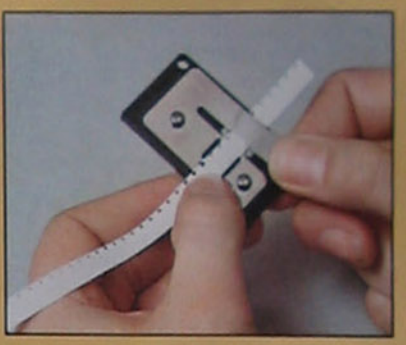
Sound projectors work mainly at preset speeds, normally 18 fps, although 24 fps is sometimes used for showing 8 mm commercial films. Amateur home movie film can be shot at 24 fps, as long as the camera has the facility. This will improve the quality of the movement in the replay but the greater film speed results in increased projector noise. And films shot at the faster rate are 30 per cent less economical—you get much less shooting time for your money.

Most projectors can run in reverse and all have fast rewind. More expensive models can run fast forward and reverse without the film first being unlaced. This is only a real advantage, however, if you are using the built-in frame counter as a cueing device, to tell you when you have reached a particular part of the film, as the image is not visible on the screen during rewinding.

Projector shutters work in much the same way as movie camera shutters. Rotating blades cut off the path of light

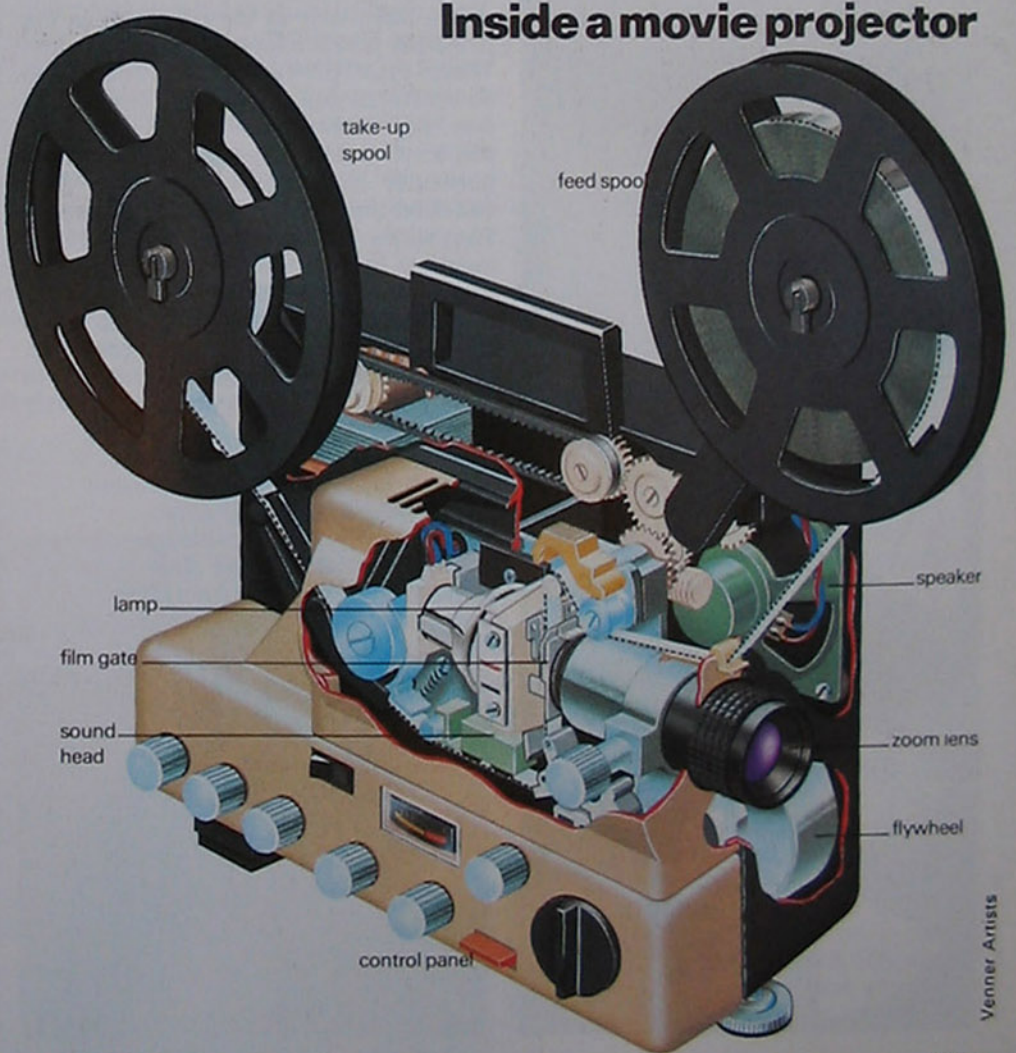
Preparing the leader

For satisfactory automatic threading the film leader should be free from kinks and creases. The end of the leader is trimmed with a trimmer that comes with the projector. Automatic threading is simple, although the film can sometimes take the wrong path and jam in the mechanism



Michael Newton/Equipment courtesy of Eumig, Rank Audio Visual

Inside a movie projector

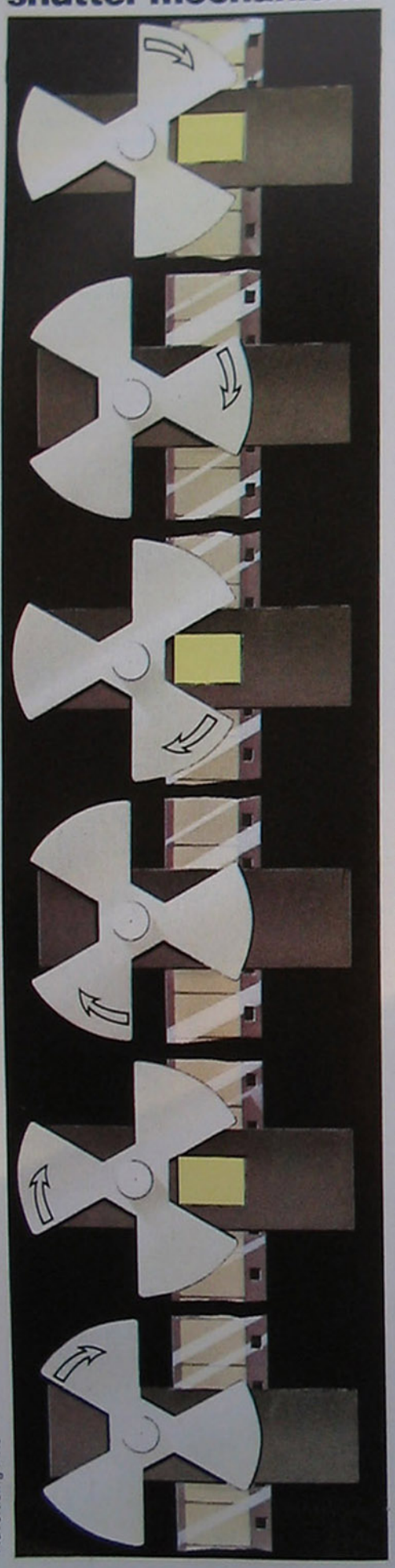


Venner Artists

Inside the projector *On sound projectors, the flywheel ensures that the film travels smoothly over the sound recording and playback heads*

Michael Newton/Equipment courtesy of Eumig, Rank Audio Visual & Agfa-Gevaert

Movie projector shutter mechanism



through the film while the claw pulls down the next frame. Some shutters are half moon shaped while others are three bladed. Three bladed shutters have the advantage of reducing the effect of flicker on the screen since each frame is shown three times. Film shown at 18 fps is therefore effectively running at 54 fps.

The optical system

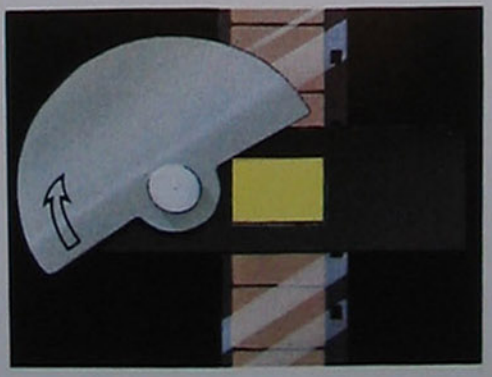
A movie projector has a similar optical system to a slide projector or enlarger. Light from a brilliant lamp is condensed into a spot of even illumination on the film. The projector lens focuses the brightly lit film on the screen.

Most modern projectors are fitted with quartz iodine lamps, replacing the old tungsten lamps which gave off a great deal of heat and required a condenser lens between themselves and the film. Quartz iodine lamps have a high power output (50 to 150 watts) but run on low voltage, a transformer built in to the projector reducing the mains voltage to 8 or 12 volts. The most up to date lamps are manufactured with an integral *dichroic* reflector. These reflect visible light, but allow infrared radiation to pass through to the back of the projector, so that the heat content is removed from the beam. They are often referred to as 'cold mirrors' since they reduce the amount of heat reaching the film. Such lamps also have a built-in condenser so that a narrow beam of bright light is produced without the need for additional condensing lenses.

The main lens of the projector is the principal factor affecting image quality. While most projectors are fitted with adequate lenses, it is well worth considering the way you will be using the projector before choosing one with a particular lens. Zoom lenses are now standard equipment on most projectors. They allow you to adapt the size of the image to fit the screen.

For the normal type of movie show—a few friends grouped around a small screen—the cheaper projectors with simple lenses are quite sufficient. It is only if you wish to move into 'big

Projector shutters *Three bladed shutters (left) have now superseded the old half moon type (below). Since they effectively treble frame speed, flicker is reduced. This picture shows the view from the lamp as one frame passes through the gate*



screen' movies that you should consider the more expensive projectors offering lenses with larger zoom ranges and wider apertures.

One further projection system is the Family 8 produced by Agfa. For little more than the price of a budget SLR, you can buy a complete movie outfit with camera and projection unit that has a built-in small back-projection screen. Although these projectors limit your film shows to small affairs, they are fun, easy to operate and provide a cheap alternative to the home video.

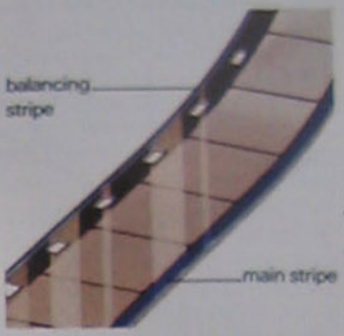
Sound projectors

If you are interested in making sound movies, when choosing your projector you must decide on the degree of sophistication you require. All 8 mm sound projectors for amateur use have magnetic sound systems. If you do your filming on a single or double system camera, any sound recorded will be held with precise synchronization (called *lip sync*) on the magnetic stripe which runs down the side of the film (see pages 862 to 863). It is always possible of course that you may wish to record additional sound on the sync track. The ease with which you can do this depends upon the type of projector you buy.

Single track projectors have only one magnetic head and there are two ways in which more sound can be added. The first involves transferring the sound from the film to another recorder and then back again, mixing in the new sound as you do so. The problem with this method is that unless you have the complicated gear needed to count the frames you may lose lip sync, though you can always try again and again until you get it right. An alternative technique is called *sound on sound*. Several manufacturers now produce projectors with this facility, the cheapest costing about

Michael Newton/Equipment courtesy of Rank Audio Visual

Twin track projectors, *like this one, and stereo projectors have two magnetic heads. The second head can record and play back using the narrow balancing stripe which is fitted to all 8 mm sound film to enable it to wind up evenly. Both stripes are very narrow, the main stripe being about 1 mm wide and the balancing stripe about 0.45 mm wide, so sound reproduction will never be as good as that from a normal hi-fi cassette recorder. Silent film has no stripes although they can be added after processing at some cost*



Advertising Arts

twice as much as a budget SLR. Sound on sound allows a new recording to be superimposed over an existing one, the latter being slightly erased to accomodate the new track.

The sound on sound system has two disadvantages. First, you are only allowed one go at adding new sound. If you miscue the second track, or fumble the controls, you risk ruining the original track, and the only remedy is reshooting. Second, partially erasing the original track tends to reduce the quality of sound reproduction.

With a more expensive twin track projector, much better results can be obtained. These cost about half as much again as sound on sound projectors, and employ a second magnetic head. All 8 mm prestriped film has a narrow balancing stripe additional to the main stripe running outside the perforations on the opposite side of the film. The second head on twin track recorders can record and play back using this second track, in a process known as *duoplay*.

The simplest way of handling sound mixes on such a machine is to record the new track on to the balancing stripe leaving the original lip sync sound untouched. You can then play back the two tracks together, changing the balance as you go.

Some twin track projectors have an automatic duoplay facility, where one track is faded down whenever there is a signal on the other track and up again when there is a gap. This facility is excellent for producing documentaries with background music. A twin track projector allows you to build up very elaborate soundtracks bit by bit with no risk of ruining the original lip sync track. You can record additional sounds—music, commentary, footsteps or a door slamming—separately and precisely in synchronization on the second track and then transfer them, one at a time, to the original track. A further use of twin tracks might be to record a second language commentary on the spare track, so producing an instant language change film.

Twin track projectors only have one amplifier, so you can only play back the two tracks mixed together. More expensive *stereo sound* projectors, on the other hand, have two completely separate sound systems. These can be played back through the projector's amplifiers and speakers or plugged into your home hi-fi system.

Although this system may appear more versatile than the twin track system, it can be more limiting. If, for example, you have filmed and recorded,

Equipment courtesy of Eumig

Stereo projector *This sophisticated machine can be used as a single track, duoplay or stereo projector, and has a built-in computer to aid sound recording*

Family 8 *A screen and a darkened room are not needed with this compact projection unit. It comes in an outfit which includes a camera and films*

Equipment courtesy of Agfa-Gevaert

in lip sync and in stereo, a conversation between two people, the only way that you can add extra sounds is either by sound on sound superimposition, or by using expensive synchronization equipment. If you are really keen to try your hand at mixing and adding sounds, there is no real advantage in buying a stereo sound projector. Bear in mind also that the magnetic stripes are very narrow, the balancing stripe being about 0.45 mm wide, so the quality of stereo reproduction may not be as perfect as you had hoped for.

Before you spend any money at all on a projector, first examine all the possibilities. Decide what kind of filming you want to do now and what you might want to move on to in the future. Simple filming needs only simple equipment and it is pointless paying out for features you may never need.

Understanding...

Basic optics

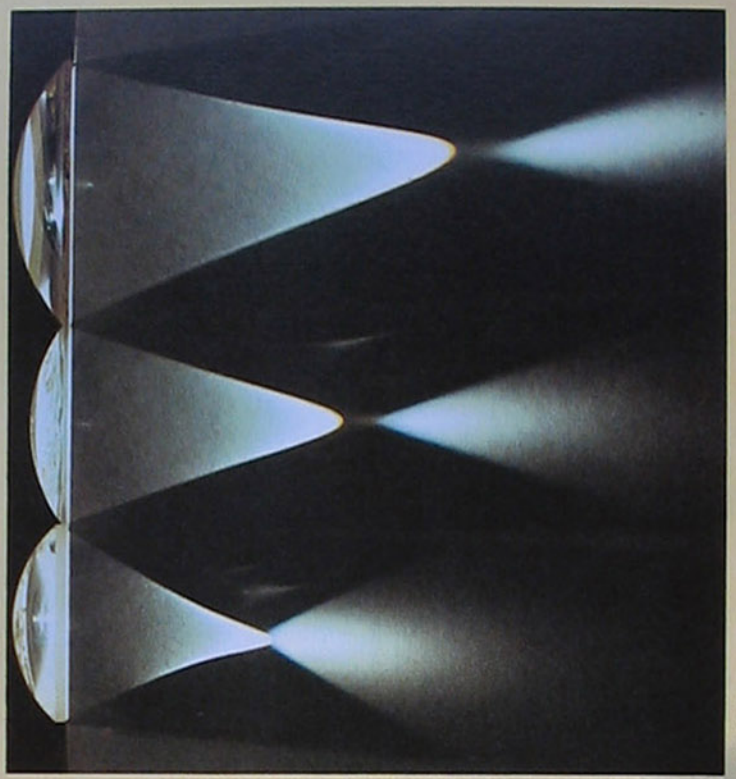
The formation of an image by a lens is at the heart of the photographic process. But understanding how this is achieved involves knowing how basic lenses behave

Most photographers know how to use lenses without actually knowing how they work. This is hardly surprising considering how complex modern photographic lenses are. However, although modern lenses often seem dauntingly complex, all lenses conform to a few basic laws. It is useful to know the principles on which these laws are based in order to understand just how lenses are designed.

Lenses work by bending, or refracting, the light passing through them (see page 271). In fact, all transparent materials refract light, but lenses do it in a more controlled and precise way. The most important factors in this respect are the refractive index (see page 932) of the material from which the lens is made, and the shape of the lens.

Most lenses have curved surfaces. These either curve outward, and are called *convex*, or inward, and are called *concave*. Lenses also vary in the degree to which they curve. By combining surfaces of different types and curvatures, a wide variety of lenses can be produced, each with its own characteristics. But for the sake of simplicity, they can be divided into two main types—*positive* and *negative*.

Positive lenses are important to photography because only they produce *real* images—ones that can be focused on to a screen such as film. Lenses of this type are used as the main elements in photographic lenses. They can have two convex surfaces (*double* convex), one flat and one convex surface (*plano* convex), or a mixture of both where the edges of the lens are thinner than the middle (*convergent meniscus*).



Jack Tait

Focal length *The lenses above have different focal lengths so the light is focused at different distances*

Negative lenses, on the other hand, give *virtual* images which cannot be focused on to a surface, but can be viewed by the eye. Instead of the light converging to a point—as it does with positive lenses—it diverges after passing through the lens. They thus have exactly the opposite effect to positive lenses. Combine a positive lens with a corresponding negative lens, therefore, and they cancel each other out—negative lenses are often used in conjunction with positive elements in camera lenses, to control focal length and aberrations. Negative lenses are also used for camera viewfinders, and as spectacle lenses for people who are short sighted. In a similar way to positive lenses, negative lenses can be divided into double concave, plano concave and *divergent* meniscus types. In each case the centre of the lens is thinner than the edges.

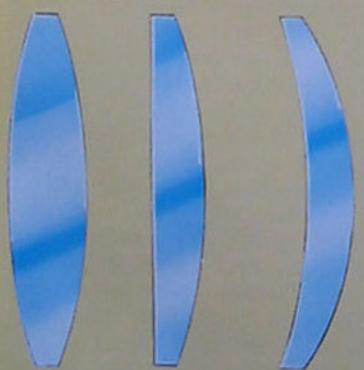
Every lens, both positive and negative, has a particular focal length. With a positive lens, when rays of light, which are parallel both to each other, and to the *optical axis*—a line passing through the very centre of the lens, known as the optical centre—are refracted by the lens, they converge on a particular point. This is the *rear principal focus*, and the distance from this to the lens is the focal length of the lens.

Other light rays, which are not parallel to the optical axis, are brought to separate focus points. But these are all in the focal plane, which is at right angles to, and passes through, the principal focus. With a negative lens, the rays do not converge, and the focus of a negative lens is simply a theoretical point found by tracing the divergent rays back to their apparent origin. This article, though, is mainly concerned with positive lenses.

The focal length of a particular lens is usually found by the process of ray tracing (see page 932). This involves mathematical calculations for which it is necessary to know the refractive index of the glass. The various types of optical glass have refractive indices from about 1.4 to 1.9. The former is of the *crown* type, commonly used as window glass. The latter is a typical value for glasses of the *flint* or *dense flint* types, which are heavy and commonly used for cut crystal glasses. Some lens manufacturers—such as Leitz—have special glasses made with specific refractive indices, to conform with their lens design.

The focal length is found by establishing the shortest distance from the lens at which an image can be formed. While light rays from infinity converge on the principle focus of the lens, rays from objects closer than infinity are brought to a focus farther away from the lens.

Simple positive lenses



Simple negative lenses

If the image needs to be focused on a fixed surface such as the film in a camera, therefore, it is necessary to move the lens away from this surface in order to focus on closer objects. This is why extension tubes and bellows are used for macrophotography. They simply increase the lens to film distance.

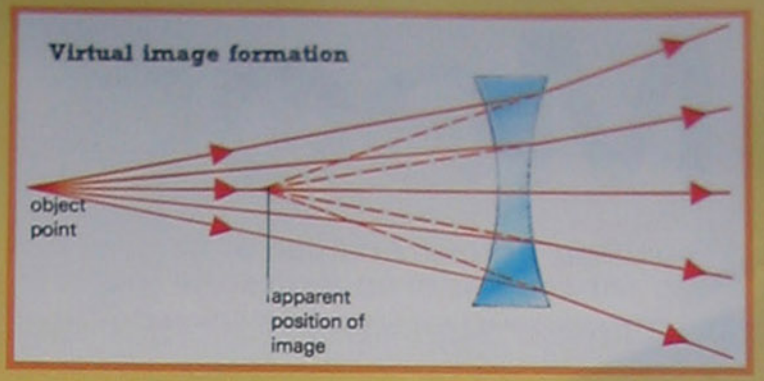
As light can pass both ways through a lens, there are in fact, two main focus points. In the case of a lens which is symmetrical, the *front principal focus* is the same distance from the lens as the rear principal focus, though on the opposite side to it. With lenses which have two different surfaces, the respective distances will also be different.

Once the focal length of a lens has been found, this information can be used to determine other aspects of the image, such as its position and magnification. The technique used is based on *geometrical optics* and, although similar to ray tracing, uses graphical methods rather than mathematical calculations.

The process involves the use of scale drawings, and allows the image to be measured, and compared with the subject. It can also be repeated for subjects at various distances from the lens. But to avoid having to repeat the process dozens of times, a formula derived from the geometry of image formation can be used instead. And from this basic formula, known as the *lens equation*, other equations can be produced, relating to image magnification.

Most of these equations and ray tracing methods are mainly used for positive lenses. This is because, although negative elements are used in photographic lenses, the final effect of a complete lens system must be positive in order to form an image. But the calculations can equally be applied to negative lenses if a negative value is given to the appropriate figures (the lens to image distance will be negative).

In addition, although the above examples have been applied to a *simple* lens (one element only), the principles are equally applicable to a photographic lens which has several elements.



Negative lenses *The image formed by a negative lens is virtual, and so the focal point is only theoretical*

How focusing affects image size

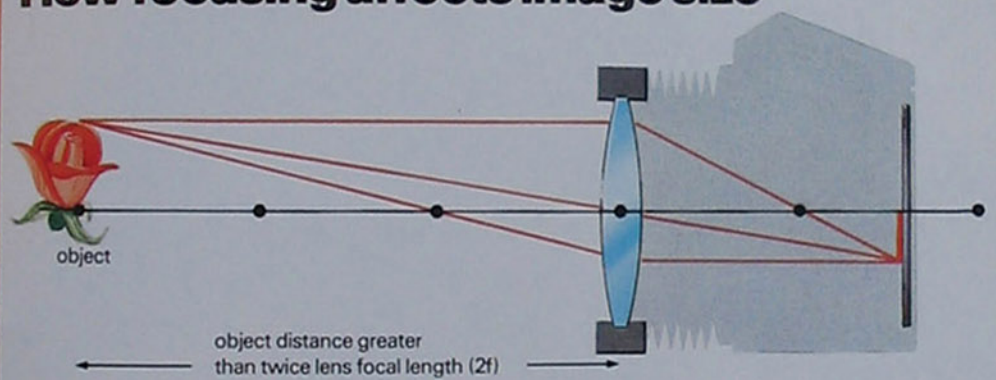


Image smaller than object

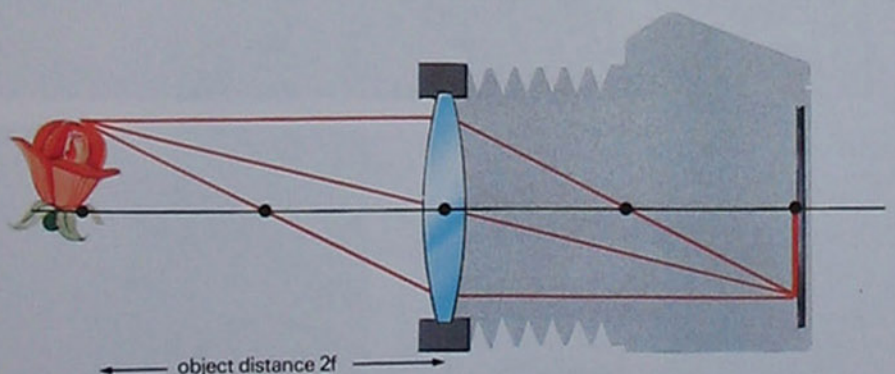


Image same size as object

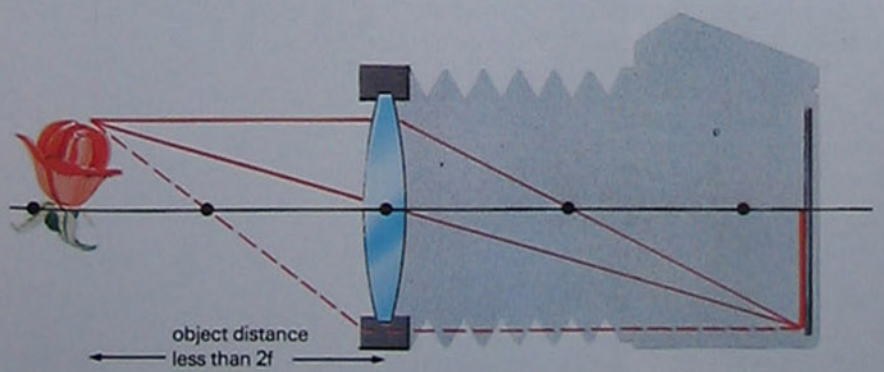


Image larger than object

Advertising Arts

Michael Newton/© Marshall Cavendish

Creative approach

Mood

Your choice of composition, colour, and use of certain films or darkroom techniques can alter, enhance or exaggerate the mood in a photograph

C. Senechal/Sepia

Imagine a shot of a tiny figure ambling despondently through a rain-soaked street or a wide angle shot of an aggressive looking man looming over the camera, starkly illuminated by a single spotlight—both are obviously 'moody' photographs and depend upon their mood for their impact. While mood is a subjective and rather elusive concept, there are many features that give a picture a distinctive 'feel'. By using these features creatively, you can bring out or heighten the mood of a particular subject and give a picture added impact.

Of course, before you attempt to introduce elements of mood into the picture, you must decide just what kind of mood you are trying to establish. With some subjects this may be so obvious that it hardly needs any emphasis—a bright, smiling child, for instance, usually looks so happy that you need few other clues to the mood. With others it may be so subtle that you hardly notice it. Sometimes, you may want to give a subject atmosphere even when it has no positive mood of its own.

House in the clouds *Try shooting from an unusual angle and darkening the sky with a filter, or by underexposing, to create a mysterious, foreboding mood*

One of the most obvious clues to mood is the overall lightness or darkness of the image. A light tone, for instance, gives a feeling of openness, of freedom and space; a dark picture suggests enclosure and weight. Shooting in different lighting conditions can, therefore, change the whole mood of a subject. In gloomy weather or at night, for instance, a rather mundane industrial landscape can be transformed into a vision of dark, satanic mills. The effect is particularly dramatic if the top of the picture is very dark and seems to weigh down on the whole scene. But in cloudy weather, the exposure needed for the landscape may be so long that even the darkest sky is rendered very light. A graduated filter,

Gordon Parks

Lady in white *For a carefree, relaxed feeling, use a high key approach—light clothes and background—and keep the composition as simple and open as possible*

Clean sweep *A clean, pale blue background can create a cool, rather detached atmosphere—giving a whimsical, faintly surreal effect with everyday objects*

Passing figure *Jarring colours and strong diagonal lines produce a restless mood, here emphasized by the way the man is looking out of the frame*

Mike Salter

either neutral density or coloured, should solve this problem and may be used—with strange effect—to create a heavy mood even on a good day.

Another important clue to mood is the colour of the image. Reds and oranges are often called 'warm' colours. They are friendly or exciting, and appear to come out of the picture. Blues, on the other hand, are cold colours, and are distant, remote or unfriendly.

Mood can also be affected by the interaction between colours. Strong, clashing colours tend to create a sense of restlessness or tension—at carnivals or fairgrounds they are chosen deliberately to evoke a mood of excitement and exhilaration. Soft, pastel colours, however, help to produce an atmosphere of gentleness and peace. A landscape taken in a light mist, when colours are muted and delicate, has a mood of tranquillity. Old photographs often have a calm

Gabe Palmer/The Image Bank

Gymnast *Bright reds and slashing diagonals in contrasting colours give a vibrant, energetic effect—ideal for an action shot.* **Seascape** *A completely level horizon is very restful to the eye and, in a simple composition, contributes to a mood of peace and tranquillity.* **Avenue** *With a vertical format, the tall, stately rows of trees in an avenue creates a very calm atmosphere, here enhanced by the small size of the figure and the warm, mellow tones*

mood simply because the colours have faded into subtle pastels.

Conversely, you can use dark, saturated colours to convey a mood of luxury and opulence in a photograph. Certain still lifes are enhanced by the presence of such a mood, and if you look at advertisements for brandy or the more glamorous types of chocolates, for example, it is clear that advertising photographers are well aware of this fact. A similar use of colour is often used to give a sense of power and dignity to portraits of important people.

Framing the picture so that it contains only different shades of the same colour, perhaps a seascape in delicate shades of pale blue, is a very effective way of producing a particular mood.

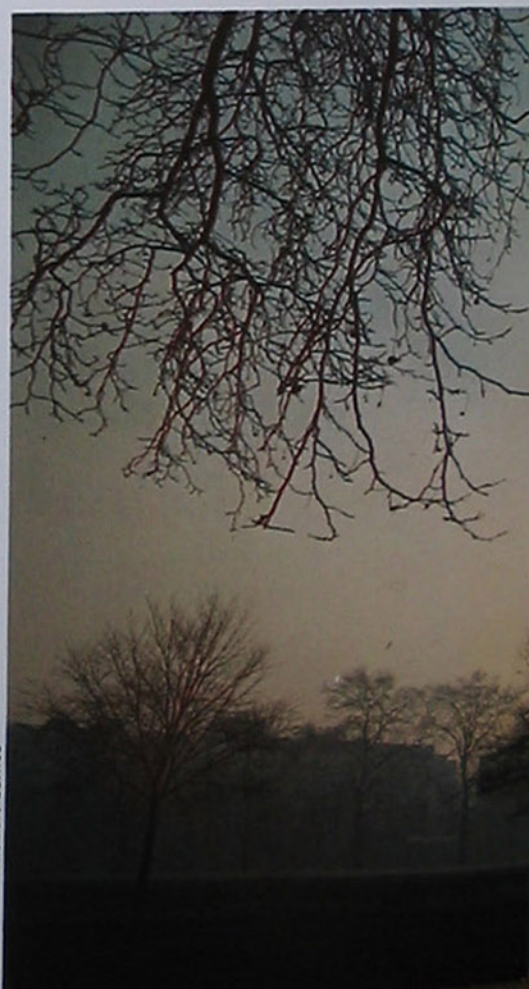
Sensitive use of colour is vitally important when capturing or creating a particular mood in a picture, but no less important is the use of composition and line—the composition must complement the mood created by the colours. The mood of a picture with soft, harmonious pastel colours, for instance, may be destroyed by jagged, diagonal lines running across it.

Lines running across the frame usually convey a feeling of restlessness or excitement. You can use this effect if you are photographing sport—try to catch the subject as it cuts across the picture, or even tilt your camera so that it appears to be at such an angle.

A mood of loneliness can sometimes be emphasized by the use of space in a picture, showing the subject as a small part of a large and remote scene. A photograph showing a tiny figure on a beach beside massive cliffs, for example, might suggest isolation. The colours that are most sympathetic to this mood are cold, quiet tones, blues and greys. The introduction of a warm, friendly colour, such as orange, or yellow in the clothes of the figure could disrupt this mood.

The photographic qualities of a picture—how sharply focused, contrasty or grainy the image appears—can be also used creatively to convey a mood. A coarse grain in a colour film can give the feeling of sensuality to a picture, as well as lending a quality of soft focus to the image, and giving the appearance of dim light. Nude studies and certain portraits can benefit when these qualities are emphasized and a mood of candlelit intimacy results. There are many ways of ensuring that the desired clues to moods are included and those jarring elements are excluded. You may be able to focus differentially, for instance. You can ensure that a photograph is symmetrical, or that the shapes within it are balanced in order to calm the mood of a picture. This can often be achieved simply by moving your viewpoint. Alternatively, you can upset the natural balance in a picture to create a mood of tension or urgency. Using the camera at an angle, giving diagonal instead of vertical lines, can help produce this mood. Always

Landscape *A light, cloudy sky can be darkened with a graduated filter to add a touch of drama to an otherwise rather uninspiring landscape*



Robert Eames

try to make sure that all the elements in the picture work together to give the same moods.

Even the film can make a difference. Kodachrome, with its sharp, rich colours, has a very different range of expression from, say, Ektachrome 400, which has softer colours and is grainier and less sharp. However, with Ektachrome you have the possibility of varying the contrast in processing which makes this a much more flexible film for expressing subtle emotions.

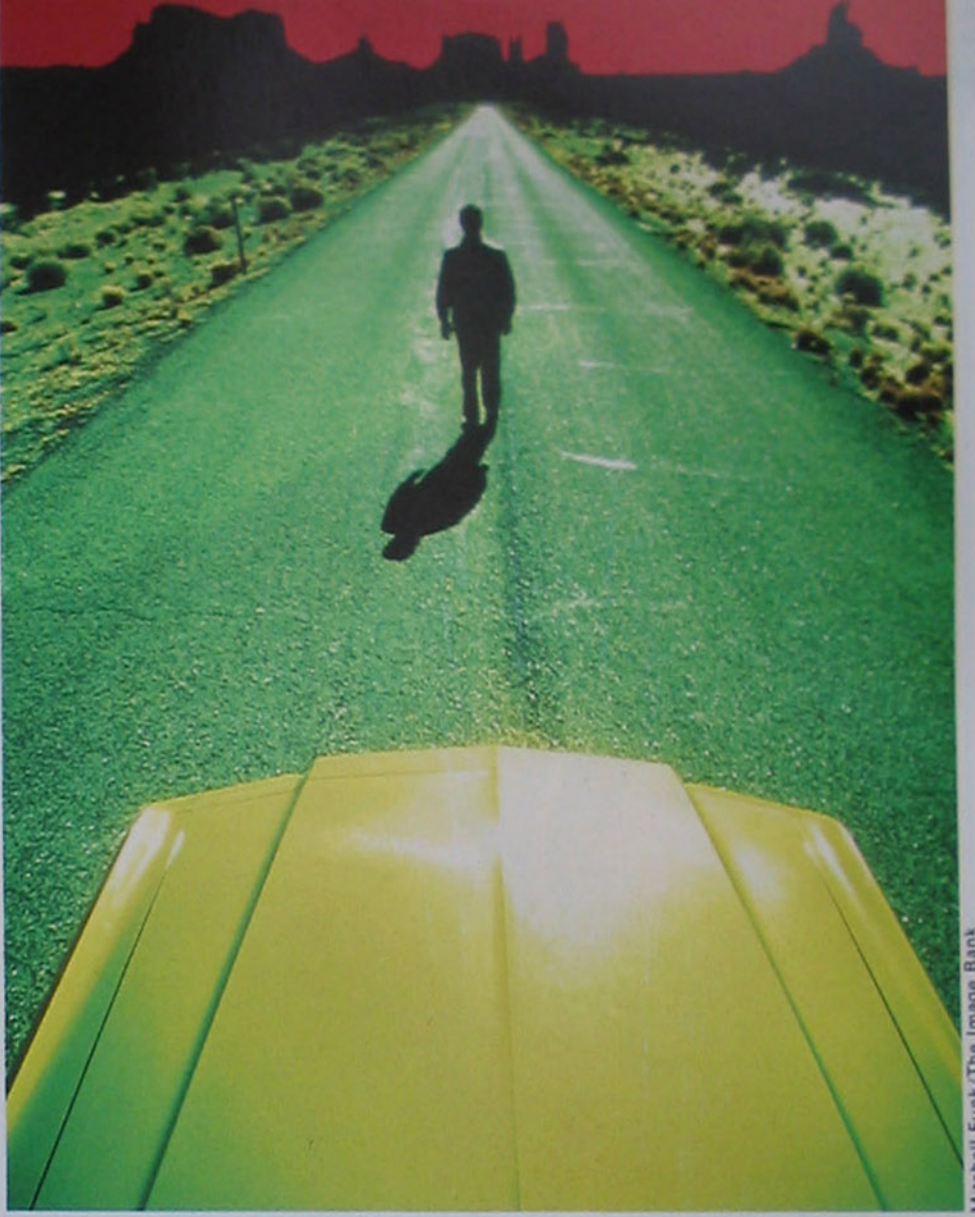
The effect of the colour film itself can be enhanced or modified by careful use of special effects filters, perhaps to add soft focus for a more romantic feeling, or combined with over exposure to give more pastel colours. Although with colour film you can exploit the cues to mood that are associated with different colours, when working in black and white you can take advantage of a number of darkroom techniques to create or enhance a particular mood.

Photographers often talk of 'printing down' or of a 'heavy' print when referring to a dark image, or 'opening up' to make a print lighter. For instance, you may have taken a picture of a graveyard in which you want to create an oppressive and mysterious mood. Making a darker print than normal, particularly in an area of sky, helps achieve this mood. On the other hand, you can create a lighthearted, youthful mood in a portrait of a young girl, for instance, by making the print lighter than normal.

There are many other darkroom techniques you can use to add to the emotional impact of a black and white composition. You can use toners to convert the black image on the print to a brown, red, blue or other colour. Various black and white papers also give subtle differences in print colour. You can exploit these fine differences in creating just the right tone for your black and white print.

The overall size and shape of the image also makes its contribution to the mood of a picture. A large print will make the most of the grandeur of a landscape, and a tall, thin print may add to the impression of height in a view of a waterfall.

With colour prints you can add to the emotional impact and mood of the picture by choosing an appropriately coloured mount. It is difficult to lay down hard and fast rules for this, so it may be a good idea to keep a stock of different coloured pieces of card or paper handy, and to try each one in turn.



Mitchell Funk/The Image Bank

Man and car *By deliberately creating false colours either with special films or in the darkroom, you can transform an ordinary scene into a menacing world*

Misty morning *The soft outlines and pastel colours created by misty weather can give a peaceful, rather poignant mood to some winter landscapes*

Liquid emulsions-1

Making your own emulsion is a fascinating venture which puts you in the shoes of photography's early pioneers—and has the added advantage that it enables you to print on almost anything

Gavin Cochrane/photographic images by Peter Truckel

Even the wide variety of print materials currently available (see pages 1026 to 1029) have their limitations. From time to time it can be interesting or useful to be able to make photographic prints on quite unusual materials, particularly those which are not flat. Apart from the novelty value of being able to print a face on to an egg, you might want to print details on to other unconventional surfaces, such as metal trophies or plastic toys. To do this, you must make the surface sensitive to light by coating it with a thin layer of photographic emulsion.

Conventional emulsions are complex and require precise control. They are not sold commercially in their raw, uncoated form. But it is possible to make simple emulsions at home which will be adequate for a variety of elementary applications. They will be black and white only, and will not be as versatile as those of commercial print materials, but they open the door to a wide variety of fascinating experiments in printing.

Photographic plates *Glass, porcelain and wood are particularly good as a support for liquid emulsion. The final image can be protected by varnish*

You can either make your own emulsions from various chemicals or buy ready made emulsion in a kit form, with complete instructions. The method you choose depends on your facilities and your level of interest in actual emulsion making. It is cheaper to make your own, but the commercial product is more convenient. The techniques used to coat the emulsion on to the base or *support* are identical in either case.

Making an emulsion

The basic method of making an emulsion is to mix chemicals which react to form a new product—a light-sensitive *precipitate* which falls to the bottom of the container. This precipitate is lumpy, however, and cannot be spread evenly and smoothly on a suitable support. To overcome this, the precipitate is combined with gelatin, which suspends the precipitate uniformly and allows it to be spread evenly on a suitable support, where it sets as a jelly. One of the properties of gelatin which is used to advantage in emulsion making is that it also increases the precipitate's sensitivity to light. So although a number of substances like gum or egg white could be used as a support medium, gelatin is preferable for this purpose.

All the chemicals used to prepare the emulsion should be readily obtainable from your pharmacist, although some may have to be specially ordered.

The chemicals you will require are silver nitrate, which is rather expensive, and potassium bromide. In addition you will need gelatin—the clear variety, in powder form, used for cooking is perfectly adequate.

Your mixing containers should be glass, stainless steel or plastic. Do not use copper, bronze, brass or iron utensils as these react with the silver halide in the emulsion. You will also need some means of weighing the chemicals—an accurate balance will do, though you must make quite sure that it does not become contaminated by the chemicals. A further requirement is a means of heating your containers to about 70°C. The safest way of doing this is to immerse your containers in water from the hot

Gavin Cochrane

Emulsion ingredients *Potassium bromide, silver nitrate and gelatin are available separately or ready made up*

Making your own emulsion

1 *Weigh out the required amounts of potassium bromide, silver nitrate and gelatin before beginning the mixing and emulsion making sequence (see panel 'Measuring up')*

2 *Add potassium bromide to water at about 40°C and, after mixing thoroughly, add the required amount of gelatin which should be stirred until it dissolves completely*

3 *The silver nitrate is mixed up separately to start with. Take care when measuring out and handling this very expensive ingredient. Do the mixing in subdued lighting*

4 *Bring both solutions up to 70°C using a waterbath arrangement. Then, under suitable safelighting, mix the two solutions, the reaction of which produces a light sensitive emulsion*

5 *To make the emulsion more sensitive, 'cook' it at 70°C for half an hour, pouring boiling water into the water bath to keep temperature constant. Do not dilute the emulsion further*

6 *Cool the emulsion rapidly to about 40°C by transferring the mixing jug to a bath of cold water. Then pour your emulsion into an opaque bottle—an unused developing tank for instance*

Gavin Cochrane

tap at its maximum temperature. You will probably need to buy a suitable thermometer for measuring the temperature—a cooking thermometer is adequate, but do not subsequently use it for cooking purposes.

The first stages can be carried out in the light. To begin with, mix solutions of the two chemicals in fairly warm water—about 40°C. The silver nitrate solution is made by simply mixing 10 g of the crystals in 100 ml of water. Take care with this chemical as it can stain your fingers black—it is a good idea to wear rubber gloves. Next, make up the other solution by dissolving 8.5 g of potassium bromide in 175 ml of water, followed by 20 g of gelatin which is stirred until it dissolves. If the gelatin proves hard to dissolve then simply heat the liquid to a slightly higher temperature, which will help the dissolving process. With the two solutions prepared you are now ready to produce the light sensitive silver halide solution which is your emulsion.

Working under an amber, red or yellow safelight, bring both solutions to a temperature of 70°C and slowly add the silver nitrate solution to the gelatin solution, stirring constantly. As the two solutions mix, a chemical reaction forms the light sensitive crystals, which are held in suspension by the gelatin. At this stage the crystals are very small and fairly insensitive to light. To make them larger and more sensitive it is necessary to cook them gently. Do this by maintaining the solutions at a temperature of around 70°C for about half an hour. Having done this, cool the solution fairly rapidly to about 40°C. As this solution is light sensitive pour it into a light proof storage container or seal your mixing container in an opaque black polythene bag. Place this in a cool room and allow it to set to a jelly overnight. You now have a quantity of emulsion which will keep for several weeks in your refrigerator. The emulsion remains solid at room temperature and must be warmed before it turns into a liquid suitable for coating.

It is possible to buy a similar emulsion, ready made, with the trade name 'Liquid Light'. All subsequent steps apply to both your own home made emulsions and to Liquid Light.

For supplies of Liquid Light, see the inside front cover of this issue.

Testing your emulsion

You should test every new batch of emulsion before you coat it on an object. When fresh, emulsions are slow and lack their final contrast and maximum black. These desirable characteristics are picked up by 'ageing' the emulsion, artificially if necessary.

The two tests are very simple and easy. Under amber, red or yellow safelighting, start by melting some of the

Gavin Cochrane

MEASURING UP

Silver nitrate is a particular expensive ingredient—a 25 g bottle will often cost about as much as a box of 100 sheets of A4 black and white printing paper. Even this small quantity will make a substantial quantity of emulsion, however. The quantities mentioned in the text enable you to make sufficient emulsion to cover an area of up to about one square metre. If you feel that this is too much for your first experiments, halve the quantities mentioned. Without preservative (such as added in manufacture to the Liquid Light product), your home-made emulsion may last no more than a day or so even under refrigeration.

If you do not have access to a suitable chemical balance or accurate letter balance, ask your pharmacist if he can package up raw chemicals in quantities you specify.

To prepare a five per cent gelatin solution, simply dissolve 5 g of gelatin in each 100 ml of water heated to 40°C or above. This solution can be used for subbing most types of porous surface. Polyurethane varnish or shellac can be used instead for this job and may prove better on very porous surfaces

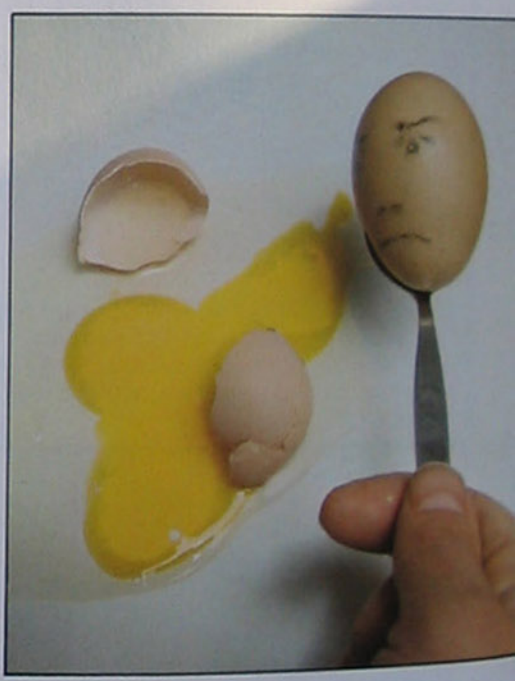
emulsion. To do this, place your storage bottle in a container of very hot water. Spread a little of the emulsion on to a piece of card using a gloved finger. When it has become tacky develop it, without any exposure, in your normal paper developer. Give it a quick rinse and then put it in a hardening fixer for five minutes.

Turn on the lights and inspect the test piece for signs of fogging. The emulsion should appear clear and transparent. If there are any signs of blackening then a suitable restrainer or anti-fog agent should be added to the developer (see panel). A bottle of restrainer is included in the Liquid Light kit in case it is required. This is best added gradually using a pipette or dropper.

The purpose of the restrainer is to discourage the formation of 'chemical' fog caused by those developers which act on unexposed as well as exposed silver salts in the emulsion. Fast acting (highly active) and contrasty developers are most likely to cause fog problems and instead of using one of these, with restrainer added, you may get better results by using a soft-working fine grain developer such as you may use for film.

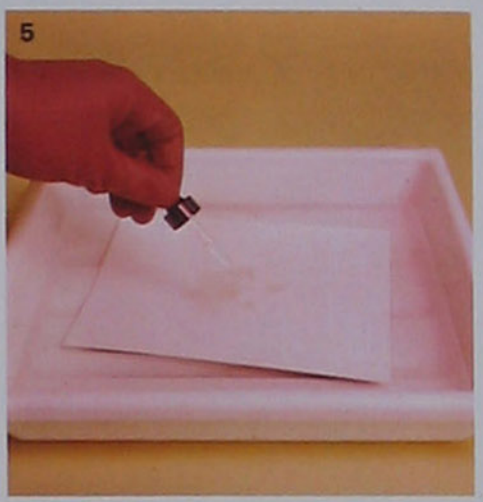
A concentrated solution of potassium bromide can be used as a restrainer.

Ray Duns



Egg flip *You can coat liquid emulsion on almost any surface—and this includes eggs. First blow the egg and then coat it by dipping it into a container of melted emulsion. Omit the stop bath during the processing as acid dissolves the shell.*
Printing on glass *You can coat the inside or outside of plain glass objects such as tumblers. The convex surfaces means that the original image must be contact printed unless the distorition is acceptable. Tape the negative to the glass, place black paper on the inside and rotate the glass for even exposure*

Testing your emulsion



Every new batch of emulsion should be tested before use. Start by placing your storage container in a bath of hot water to melt the emulsion (1). Under safelighting, brush a little of the melted emulsion on to several pieces of stout card or paper (2), and put these aside to dry in a light tight and well ventilated place. To save time you may find it better to carry out the coating immediately after making the emulsion. Without exposing your test piece, immerse it in working strength developer for the normal development time (3). If, after that time, it is clear that some fogging has occurred (4), add restrainer a drop at a time until fogging ceases on subsequent test runs

Gavin Cochrane

Mix up, say, a 5 per cent solution (see panel) and add this drop by drop, mixing well, until fogging ceases. If you add too much, the developed image will have a greenish rather than warmish tone. As an alternative, make up a solution containing 1 per cent each of sodium carbonate and benzatriazole, adding this in the same way.

If the fog level is acceptable then a further test is carried out for sensitivity. This involves coating a small piece of card as before, but this time give an exposure similar to that for an actual print. Develop as before, remember to add the anti-foggant to the developer if it is required. If a good black and reasonable contrast are not obtained the emulsion is probably too fresh and has to be aged. To do this, place another storage container in a bowl of hot water (at least 60°C) for about an hour. Having done this, carry out a further test to check that your emulsion now has the required characteristics.

Preparing the surface

You can coat your emulsion on to virtually any surface but the key to success is in preparing the surface beforehand. In most cases it is best to apply a foundation or *subbing* layer before coating. Surfaces can be divided into roughly three categories and each of these requires a different type of subbing layer.

The first category includes the surfaces of the non porous type, including glazed ceramics, glass and some types of stone. These surfaces need to be thoroughly cleaned by scrubbing the surface with a solution of hot washing soda and then coated with a 5 per cent gelatin solution which is applied in the same manner as that used for emulsion coating. When this jelly layer has dried completely, dip the object into a hardening fixer for a couple of minutes to harden the subbing layer, and then wash it thoroughly in cold running water prior to drying.

The second type of surface encountered is of the highly porous or crumbly type. Such surfaces include brick, concrete, plaster, wood, paper and cloth. With paper and cloth no surface preparation is usually necessary but cloth should be thoroughly washed first to remove any chemicals in the material that may affect the emulsion when it is applied. Paper absorbs the emulsion slightly, and as the emulsion shrinks on drying it tends to curl the paper. If this becomes a problem it can be eliminated by coating the back of the paper with a five per cent gelatin solution which is allowed to dry before you coat the front surface with emulsion.

With other porous surfaces, like wood and bricks, it is best to seal them with a clear spirit-based polyurethene type varnish diluted 1+1 with its appropriate thinning fluid. This allows the emulsion to adhere to the surface without soaking in unevenly, thus preventing an uneven final image.

The final type of surface is one that will chemically affect the emulsion, such as metals containing brass and iron, which react chemically with silver halide, or others that contain sulphur compounds such as prepared artists' canvas. These surfaces need sealing to prevent any reaction taking place. Once again a diluted polyurethene varnish can be used. In the case of canvas, first coat the surface with cellulose primer diluted in the ratio 40 per cent primer to 60 per cent thinners, if necessary using two coats to get an even surface. Allow this to dry for at least one hour before applying the liquid emulsion.

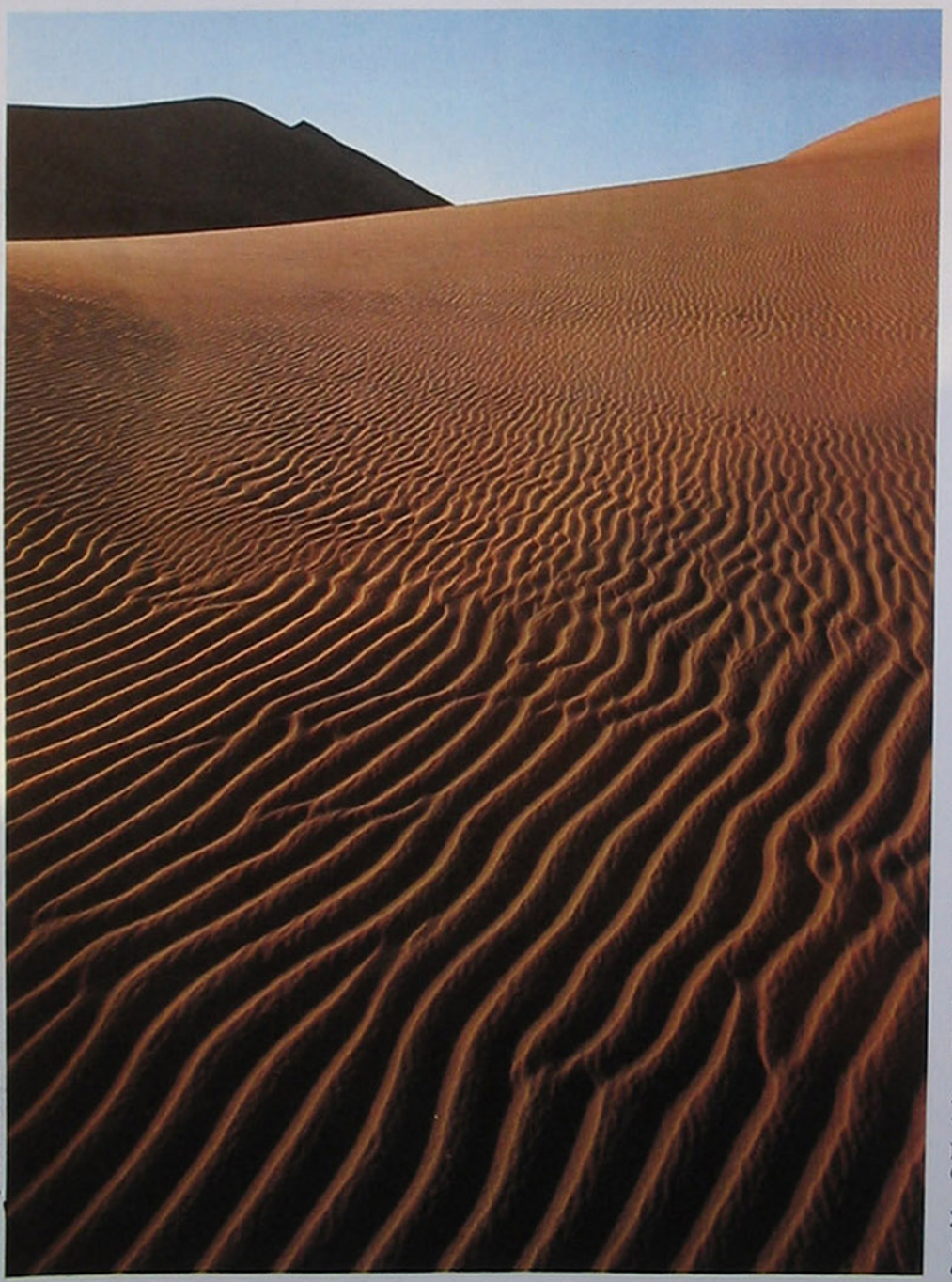
Where a surface does not appear to fall into any of these categories then test a small piece for emulsion adhesion. If a good bond is not obtained then you will have to either coat the surface with gelatin or try one of the sealing materials mentioned.

The next steps, of actually coating a surface and developing the image, are fully covered in the following Darkroom article.

A sense of perspective

A photograph is always a flat, two-dimensional image, but by exploiting perspective you can produce an illusion of depth to make a scene more convincing

Jerry Young



Carol Hughes/Bruce Coleman Ltd.

Perspective sometimes seems like rather a dry, textbook topic, but it has particular importance to photographers. When we take a photograph, what we are usually trying to do is to create an illusion, so that the print we eventually make conjures up a convincing view that closely resembles the original scene. To do this, some trick is needed, because a photographic print or a projected slide is completely flat, and the original scene is generally three-dimensional. Perspective is what performs this trick, and enables us to see depth in a flat image.

In real life we have no difficulty appreciating the space, depth and solidity of scenes around us: our eyes give us stereoscopic vision, and by moving around we experience *parallax* (the apparent change of position of different objects as we walk by them gives us a clue to their size and distance). On the flat surface of a print, however, this three-demensional sense is altered and with a knowledge of perspective, we can exaggerate, distort or reduce the sense of depth in a photograph, or even eliminate it altogether.

Linear perspective

Probably the most common and easily recognized form of perspective is *convergence*. Parallel lines leading away from the camera appear to converge towards a common point where they meet. This imaginary point is called the *vanishing point* because it is the point at which we can no longer see the parallel lines clearly—they vanish over the horizon.

In a photograph taken from one end of a street of houses, this convergence is very pronounced—the lines of the pavement, rooftops, window ledges and chimneys all draw together towards the

Rippled sand *The texture of the windswept sand creates a sense of depth despite the lack of converging lines*

Working at height *Converging lines, here the verticals of a building, add to the impression of height and drama in the shot*
Humber Bridge *Lines converging towards a vanishing point convey depth*
Jerry Young

horizon. When we look at the original scene, we see the lines converging in the distance, but we know that they are really parallel. If we turn, then, to look at the photograph, we see the same convergence, and our experience of the real world leads us to interpret it as depth in what we know is a flat picture.

Convergence is only one example of linear perspective, but there are others, all of which can give a convincing impression of depth to the flat surface of a photograph. The diminishing size of objects as they recede into the distance strongly suggests depth, particularly if each object is of similar size, and they are placed at regular intervals. This phenomenon is so familiar that it seems perhaps barely worth mentioning, but in the absence of all other clues to depth, it can still evoke a strong feeling of space or emphasize the impression of depth in a photograph.

Closely connected to the effect of diminishing size is *foreshortening*. This again occurs progressively at a distance, and is the apparent compression of objects as they get farther away. If we look at a row of lamp posts, for example, the ones which are most distant seem to be packed more closely together than those nearer to us. Foreshortening also makes rounded surfaces seem flatter—faces seen from a distance appear flattened out and lacking in depth.

Textures and regular patterns also help to add depth to a picture, particularly where the textured surface slopes sharply away from the camera. Patterns seem to be more tightly packed in the distance than they are close to the camera, and this can be clearly seen on a pebbly beach—the texture of the pebble pattern seems progressively finer as it gets farther away. This effect is called *texture gradient*.

These four perspective effects—convergence, diminishing size, foreshortening and texture gradient—are all different forms of linear perspective, and they can all be effectively used by the photographer to give an impression of depth to a picture. The more clearly and strongly that linear perspective appears, the more compelling is the sense of recession and space. There are a number of simple ways in which you can control the convergence of parallel lines and other similar linear perspective effects.

The most important of these is viewpoint. By moving closer to the subject of a photograph, you can make perspective more extreme, so that parallel lines in a scene converge more strongly and there is a dramatic size difference between parts of the subject near the camera, and more distant parts. Moving away reduces the perspective effect, and makes the scene appear flatter.

A change of viewpoint is the only way to truly change the linear perspective in a photograph, but there are other ways in which we can change the appearance of a picture, to exaggerate or suppress the sensation of depth. These techniques do not cause true changes in perspective, though—they only appear to do so. For example, it is commonly believed that wide angle lenses produce steeper perspective, and that telephotos suppress it. In actual fact, the change in perspective is not caused by changing lenses, but by a change of viewpoint—in order to fill the frame, a photographer using a wide angle lens needs to be closer to the subject than a photographer with a telephoto. Perspective is exaggerated by the close viewpoint, and we associate this kind of view of a scene with the use of a wide angle lens.

Cobbled street *This conveys a strong feeling of depth without the use of convergence. The texture of the cobbles and their foreshortening—the texture gradient—along with the foreground lamppost, leads the eye into the picture*
Trevor Wood

John Hawkins/JS International

Camel train *Here, the perspective effect is produced entirely by the foreshortening of the camels*

Perspective in practice

In practice, this distinction between an apparent perspective change and a real one is academic. Photographers are not usually interested in geometric constructions and theoretical considerations, but are more often concerned with what the final image is going to look like.

Moving closer to, or farther away from, your subject changes the appearance of the final image, and so does changing the focal length of the camera lens. What other methods of controlling linear perspective are there?

The angle of the camera and its proximity to any flat surface have a considerable effect upon perspective. The obvious example is a picture of a building. Tilting the camera upwards causes any parallel vertical lines to converge very noticeably towards the top. If you want an architectural record shot of the building, you usually want to eliminate this convergence. The way to do this is to move back away from the building and level the camera until it is at right angles to the flat surface of the building. If you cannot do this, there are other methods—a perspective control lens can, as its name suggests, do the same job.

Sometimes, though, this convergence of parallel lines is exactly what is required. To emphasize the danger of working at great height, for example, you do not wish to eliminate converging verticals. Shooting a picture of a steeplejack from a viewpoint that is directly opposite where he is working results in a boring, static picture that does not give an impression of the risk he is taking. The verticals do not converge, it is true, but a much more exciting picture could be produced by standing at the foot of the building and tilting the camera up at a steep angle. The perspective in the resulting picture slopes steeply away, emphasizing the height of the building, and the risk to the steeplejack.

This same device can be used in the horizontal plane, to emphasize or reduce the apparent distance between two elements of a picture. For example, if you are photographing two figures in a city street, a viewpoint on the opposite pavement produces a strictly literal interpretation of the distance between them. To emphasize their separation though, you might choose to shoot from over the shoulder of one of the figures. From this angle, the wall behind them

Corsican village *Objects of varying shape add depth, but can also be used to lead the eye to the main subject*

John Sims

John Heseltine

French Alps *The warm foreground colour of the poppies contrasts with the cool, distant colours to enhance the appearance of depth in the landscape*

forms a steeply receding textured surface, that converges towards the far figure, who shrinks into the distance.

Although this approach gives a strong sense of depth and recession to a picture, it is not always possible to find a conveniently sited wall. If this is the case, you can use the ground to provide a sense of depth. Bend down or lie on the ground to get a lower viewpoint, and tilt the camera down so that the horizon is near the top of the frame. The surface of the ground then sweeps dramatically away from the camera in the picture.

Other forms of perspective

Perspective is usually associated with converging railway lines or rows of telegraph poles, but it does take other forms, too. Aerial perspective is familiar to any photographer who has tried to photograph a distant view on a hazy day. Far-off hills appear lighter in tone and bluer in colour than those nearby. This effect, and the best way of using it to convey depth in a scene, is covered in detail on page 1144.

This phenomenon—of distant subjects appearing slightly cooler in hue—has an unexpected side effect, namely that cool colours such as blue and green tend to recede in a photograph. Conversely, warm colours advance from the surface of the picture. Reds and oranges come forward, even when they are actually quite a long way from the camera.

This effect is well known to artists, who often use a warm colour to make a figure stand out in a painting, and the photographer can use it to bring forward important features in a photograph. If you are taking a picture of a group of people, and you have control over what they wear, dress the most significant individuals in bright warm coloured clothing, and use cool or subdued colours for the others. The brightly coloured clothes then stand out clearly. In an extreme case, such as red coated huntsmen against green grass, the photograph can take on a remarkable three-dimensional quality.

Shadows can be used to give a sense of perspective to a scene, because the size, position and shape of a shadow are related to the object that forms them. A landscape lit by low sun has long shadows that pick out every detail of the ground, and on undulating ground, such as a hummocky grass slope, shadows trace the contours of the surface, giving it a three-dimensional appearance. In a street scene, you can use the shadows to give a strong sense of depth. If you shoot into the light, each backlit figure throws a shadow towards the camera, and because the shadow is elongated and enlarged in the foreground, it points to its source, and establishes perspective. Conversely, with frontal lighting, the shadow recedes and appears shortened in the distance.

Photographic characteristics themselves can also help to convey distance. One of the aspects of photography with which we are all familiar is sharp focus. A picture which is sharp throughout has less apparent depth than one which has blurred areas in front of or behind the principal subject. Differential focus can thus be used to produce an unmistakable impression of depth.

Controlling depth in a picture

All the techniques outlined above can be used to change the sense of perspective in a picture. They are simple to learn and apply, and they provide the photographer with the scope to tightly control the depth and solidity that appears in the final image.

The simplest way to become proficient in the use of these perspective 'tricks' is to actually put them into practice. Why not shoot two sets of pictures, and emphasize depth and perspective in one, while suppressing it in the other? For the first set, choose a sunny day, a wide angle lens and a low viewpoint, and pick a subject that has elements at a range of distances from the camera. For the other pictures, use a telephoto lens, and shoot on an overcast day when there are fewer strong shadows. Select a high viewpoint so that depth is not indicated by sharply receding planes, and try and find subject matter that lies in one plane.

You may prefer to shoot at the same location, using the two contrasting approaches. This need not be just a technical exercise, because as well as teaching yourself about perspective, you will end up with a startling pair of photographs. They will both be of the same subject, but will look uncannily different from each other. As you become more expert at controlling perspective and depth, you can use your knowledge of these techniques to great effect.

Assignment

Ballet on tour

Many of the visual elements that go to make good photographs—exciting shapes, interesting forms and dramatic action—are part and parcel of the ballet

photographs by Geoff Howard

Seat covering *A documentary approach implies photographing more than just the actual ballet and Geoff looked out for other aspects—like this interesting view from a balcony of a woman covering the stalls. Canon F1, 85 mm lens. HP5 at 800 ASA*

Geoff Howard is a documentary photographer who tackles a wide variety of subjects. Ballet holds a particular interest for him and he has covered several well known dance companies at work. For this assignment he wanted to record the European tour of the Alexander Roy London Ballet Theatre—a small, self-contained touring company. His approach is a documentary one so the photographs are as much about the high pressure life of a ballet company on the road as they are about actual dancing.

After a while the dancers became accustomed to Geoff and his cameras, although, to an extent, they were always conscious that their actions were being recorded. Geoff tried to remain as unobtrusive as possible and he avoided contrived shots. As a documentary photographer, he was concerned that the images should portray authentic behaviour and the dancers knew not to pose for his shots.

Rehearsal on stage *The white floor and background made light readings a problem but they provided dramatic contrast with the dark figures. Rehearsals and warm up exercises enabled Geoff to take his shots without getting in the audience's way.* **At the rail** *Once again, the dark costumes and bars contrast dramatically with the background, emphasizing the graceful shapes of the dancers. Canon F1 and 85 mm lens*

Knowing what sort of relationship to establish with his subjects—involvement without direction—was just part of the challenge in tackling this assignment. The other main difficulty was more technical in nature—that of working with low light levels when the subjects themselves were often in motion. Geoff does much of his work with black and white film and since he puts a lot of work into his prints, he is keen to avoid the 'horror of thin negatives'. To reduce these problems, Geoff tried to make use of the stage lighting as much as possible and to use fast films and lenses.

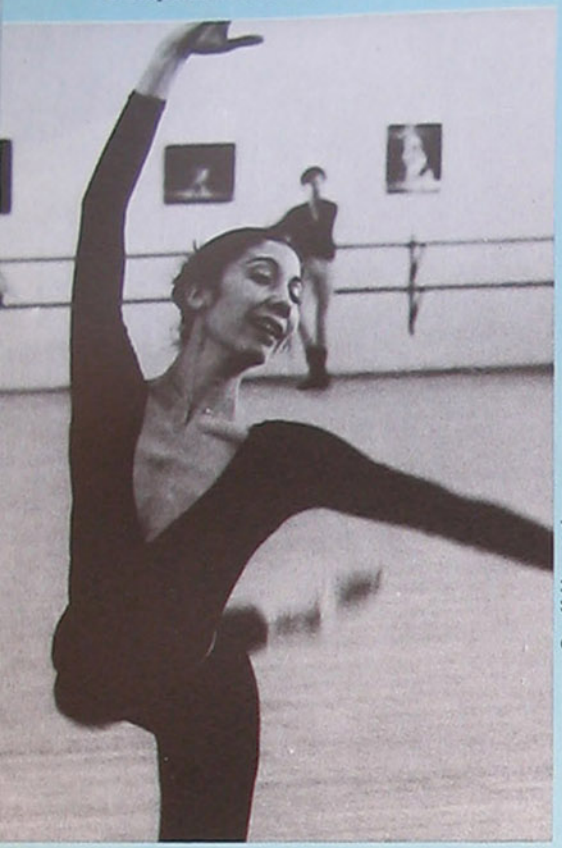
Shooting in black and white had an additional advantage in that it meant that no thought had to be given to the colour of the artificial lighting. All these shots were taken on Ilford HP5 film developed in Microphen. For most of the photographs taken with telephoto lenses, Geoff needed faster shutter speeds so he

Young dancers *At one performance the touring company was joined by a group of young dancers from a local ballet school. Geoff noticed this charming group waiting in the wings but had to grab the shot before they noticed him. The stage lighting provided just enough to illuminate them, and had the pleasing effect of separating the light costumes from the dark background.*
In costume *Backstage, Geoff noticed one of the dancers anxiously waiting for the performance to begin*

uprated the film from its nominal speed of 400 ASA to 800 ASA (ISO). This extra stop had little adverse effect on image quality but made a significant difference when it came to freezing movement of increasing depth of field.

The equipment used for this assignment consisted of a Leica M4 with 35 and 50 mm lenses and a Canon F1 which was mainly used with 85 mm and 135 mm lenses. Geoff also took along an elderly Canon VI rangefinder camera fitted with a 25 mm lens. The Leica is particularly well suited to this type of work—it is not only quiet, but also uses very fast lenses and is easy to focus in low light.

Coffee break *To cover all aspects of life in a touring company involved studying all activities—even a trip to the coffee machine. Geoff kept an eye on the machine, waiting for a shot to emphasize the itinerant life*



Geoff Howard

Dancing *These shots (left and below), illustrate how timing is critical if you wish to show the graceful shapes created during ballet movements. Geoff found that only practice could help him to choose these moments*

For these shots Geoff found that the extra stop he gained from uprating his film allowed him to use a slightly faster shutter speed. This made just enough difference when he wanted to freeze the movements of the dancers

What went wrong?

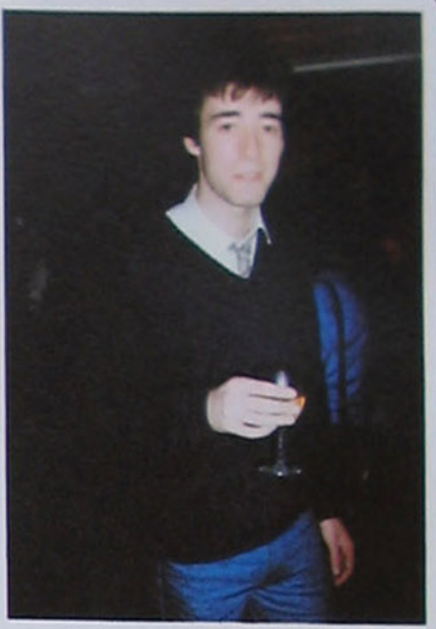
Party shots

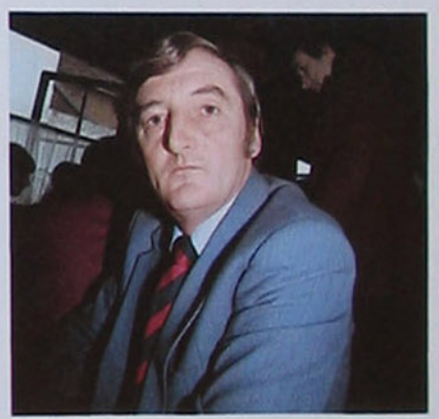
Good pictures can be taken even in the chaotic conditions of a party as long as you follow some basic rules

This picture was taken using an autofocus camera of the type that employs the image contrast focus principle. As the sensing area did not embrace significant areas of light and dark, the result is an out of focus picture. In near darkness it would be better to use manual focus settings with this type of camera. Infra red and sonar focusing cameras are not affected

This shows a classic party shot error—subjects at very different distances. The near person is twice as close as the farther one, making it impossible to judge focus or exposure accurately without consulting the scales time and time again

If you have difficulty focusing in the darkness of a party, use zone focus techniques to avoid out of focus 'snaps' like this. Simply preset your lens at, for example, 1 m for head-and-shoulders portraits or 3 m for head-to-waist shots when using a standard lens





When using a camera with built-in flash, hold the camera with the flash at the top. This prevents harsh and noticeable shadows towering over your subject (top). With wide angle lenses, make sure you use a diffuser attachment to prevent central 'hot spots' (above)

By all means take a sneaked shot of your friends (far left) but you may find a request for a picture leads to a much better result, particularly where a group of people is concerned (left). You can make better use of available depth of field, and you do not have to worry so much about flash coverage of subjects at different distances

Lartigue

One of photography's best-loved celebrities, Jacques Henri Lartigue's pictures give a uniquely warm view of life since the beginning of the 20th century

'I used to ask Papa: "Please make me a photo of that . . . and that . . . and that . . . " He always said: "Yes, yes . . . " but he never did. Well, now I can do it myself. And I know very well that many, many things are going to ask me to have their pictures taken and I will take them all.'

Jacques-Henri Lartigue wrote these words in his diary on the day that he was given his first camera—he was then just seven years old. That was in 1901. Now in his 80s, his enthusiasm for taking pictures is as great as ever, and has won him considerable acclaim and recognition throughout the world.

Although Lartigue's enthusiasm for photography has never diminished, he never tried to earn his living from it. Instead he chose to be a painter by profession—painting large colourful canvasses of flowers, and portraits for both friends and clients. Like photography and his other love, writing, painting has never seemed like work to Lartigue. All are done for pure pleasure and to capture the 'magic of passing moments.'

It is partly because Lartigue's photographs are so personal and so unaffected by any desire to please an audience that they are so charming. Looking at them you are transported back into a way of life which itself seems magical—full of laughing, happy people and new, exciting events.

Lartigue's photographs have now made him a celebrity. He has published a number of books and his work has been exhibited all over the world, with major exhibitions held in New York, London and Paris. He also appears in the pages of many glossy magazines and has been the subject of documentary films and innumerable articles.

In view of his present celebrity, it is surprising to discover that his photographs were completely unknown before the early 1960s. As he says, 'I used to show them to my friends after dinner, but until I took them to New York nobody really saw them.' Even then, it was almost by accident that they became known to the world.

In 1962, Lartigue and his wife Florette went to New York by cargo boat. To amuse herself during the six week voyage, Florette decided to make an album with some of the photographs. In New York they went to see a contact, Charles Rado, then head of the Rapho picture agency simply to find the name of a print retoucher. Rado looked at the prints and was immediately captivated.

Jacques-Henri Lartigue/The John Hillelson Agency

Lartigue *as a boy (above), with one of his first cameras, and 80 years later with his wife, Florette (below), at their home in the south of France*

Martine Franck/Magnum

At the races *An early focal plane shutter caused the weird distortion*

Jacques-Henri Lartigue/The John Hillelson Agency

By the end of the afternoon they had lunched with the directors of *Life* magazine and the Museum of Modern Art. *Life* published a selection of the pictures, and in 1963 the prestigious Museum of Modern Art gave Lartigue his first exhibition. The public response was immediate and enthusiastic. Lartigue's reputation was established.

Shortly after this a young American photographer called Richard Avedon contacted him. Avedon, who already had a considerable reputation as a fashion photographer, had also been completely enthralled by Lartigue's photographs. He kept in touch with the Lartigues and, while on a visit to Paris in 1967, went to look at the vast collection of personal diaries and photographs that Lartigue had amassed over the years since 1901.

Eventually, this casual visit resulted in the publication in 1970 of the delightful *Diary of a Century*—Avedon's edited version of some of this material. The book is impressive by any standards, and gives a privileged glimpse into the life and mind of a remarkable man. As its title suggests, it does indeed seem to be a document of everyday life since the beginning of the century, giving a remarkably warm and clear impression of the French at home and at play.

Some of the most fascinating pictures in the book are those taken by Lartigue of his family as a child and young boy. They are a unique look at the life of the French upper classes before World War 1 shattered their way of life forever.

Unaffected by any notion of how he should be taking photographs, the young Lartigue simply took the pictures he wanted to take. His brother, cousins and friends are invariably caught in the midst of some flying leap or daring ride —his brother Zissou making his first attempts at flight, his cousin Simone falling off a home-made bike, Zissou and Oleo dancing the cake-walk and Bichonnade leaping down stairs.

All these pictures give you a sense of what happened just before and just after the picture was taken. Just for a moment, you are taken back to the charmed life of the young Lartigue, constantly inventing new games with his brother and cousins.

Marching to war *One of the first signs of France's embryo airforce. Lartigue learned to fly such planes during World War 1 when this shot was taken*

In flight *His cousin Bichonnade leaps down the steps for Lartigue's camera—he was always experimenting with new ways of capturing movement on film*

Bois de Boulogne *where the young Lartigue spent hours photographing the elegant ladies that strolled through the park parading their finery*

Papa and Maman *One of Lartigue's first subjects were his parents. Here they pose for him in the garden of their house at Pont-de-l'Arche*

The pictures of this time also give an inside look into the enthusiasm for novelty at that time. Lartigue's childhood and adolescence coincided with an age of invention and his photos reflect this. The first aircraft lurch off the ground and racing cars speed out of the frame.

In his enthusiasm, Lartigue has captured not only the day-to-day life of the age but also its spirit. By 1910 when he reached the age of 16 years this enthusiasm had also communicated itself to a new subject—women.

'Instead of drawing racing autos (in my diary) I now draw women. Women . . . . everything about them fascinates me—their dresses, their scent, the way they walk, the make-up on their faces, their hands full of rings and, above all, their hats.'

The young Lartigue would now spend many happy hours photographing the elegant women who promenaded in the Bois de Boulogne. Many of his finest later photographs are also of women. He took many photographs of friends and relatives skating, playing tennis, laughing, singing and talking—all snapped in happy interludes and intimate moments. Above all, they convey the impression of Lartigue's sparkling joy in life.

Few of Lartigue's photographs show the more sombre moments of life. His writings clearly demonstrate that he has had his share of these, but he feels that photography is for capturing moments of happiness.

In order to capture these moments, Lartigue was always eager to try out new and improved cameras—particularly so that he could capture movement. Indeed an account of the cameras he has owned reads like a history of their development.

The first camera he owned while still a boy was of course the most memorable. He had to climb on a stool and drape a black cloth over his head to use it. It was a large 13 × 18 cm plate camera 'made of polished wood with a lens extension of green cloth in accordion folds.'

In the years that followed, Lartigue's cameras changed almost as rapidly as the major changes in camera design. In 1905 he was the proud possessor of a Gaumont Block Notes camera—a quite revolutionary miniature plate camera that took pictures at up to 1/50 second. Later still, he progressed to roll film with a Vest Pocket Kodak, and also acquired a German camera which could take pictures at 1/1000 second but weighed a kilo and a half! Since then he has owned a Leica, several Pentaxes, a Rolleiflex and Olympuses.

Lartigue's knowledge of technique, however, is still very limited. He has only ever wanted to learn precisely as much as he needed to, feeling that training his eye to see and improving his timing were the most important factors in his photographic development.

This feeling is also reflected in the way he talks about his work. To him it is all very simple—he takes pictures of happy moments and beautiful things. All his photography is directed towards this simple desire and his theory about picture taking is contained simply in his philosophy of life.

'When I was still very young, I was always looking for more—for purer happiness, but happiness is not an elusive bird, perched high near the ceiling, which with the help of more or less complicated ladders, you have to work to catch. Happiness is an element,

Jacques-Henri Lartigue/The John Hillelson Agency

which, like air, is *everywhere*.

Provided you don't run after it too hard and too long: you'll find it's right there, within reach, all the time . . . waiting for you to take it.'

This feeling about life shows his attitude toward photography very clearly. By photographing moments of happiness Lartigue is simply recording them. He has no more complex motives than the pure fun of it. If any message is to be derived from his pictures it is purely to see happiness when it is there and appreciate every second of it.

The photographs in the *Diary of a Century* take us through 69 years of Lartigue's life—through childhood, adolescence, and manhood and into middle age. They give a brief glimpse of his life as a painter, but most of all they continue to show his family and friends.

Nowadays, although well into his 80s, Lartigue is a slim, fit man who scarcely looks his age, and who displays a consistent and lively curiosity. He and his charming wife, Florette, both lead an active life. When they are not travelling the globe, they divide their time between their comfortable Parisian apartment and the attractive old house in a

Nastassia Kinski *Lartigue is still an active photographer and he took this photograph of the star of 'Tess' during the making of the film as recently as 1979*

Bibi in Marseilles *Careful framing and use of soft focus lend atmosphere to this picture of Lartigue's first wife taken in the late 1920s*

Riding lessons *Many of Lartigue's early snaps captured the elegance of pre-World War 1 Paris. This young rider was on the Avenue des Acacias*

Jacques-Henri Lartigue/The John Hillelson Agency

The joys of fatherhood *Lartigue took this happy portrait of his son Dani holding his own newly born son Vincent at his home in Paris in 1944*

tiny Provencal village that they have owned for over 20 years.

Lartigue enjoys this constant travelling. It gives him the opportunity to visit friends in different countries, and he finds the change of environment renews his creative energy. 'It's very good for my painting because if I leave France for a month to go to New York or California, I don't do any painting at all—I'm taking photographs. So when I come back to France, painting is like a new thing again. I don't think it's a good idea to stay in the same situation and do exactly the same thing day after day after day. It makes you stale.'

Certainly it is difficult to imagine that this astonishing man will ever grow stale. His recent work is as joyful and delightful to look at as any of his previous photographs and his photographs of friends like the Italian film director Fellini, and his recent colour landscapes are as good as those produced by any of his contemporaries.

Equipment file

Filters on test

Some photographers believe that only the most expensive filters are optically satisfactory; others believe that all are. To find out just who is right, we ran a series of tests on a wide range of different filters

Dave King/equipment courtesy of Kodak, Nikon, Introphoto, Transworld Trading & Finance and Mayfair Photographic

Dave King/equipment courtesy of Kodak & Mayfair Photographic

Thick and thin *The picture above shows the different thicknesses between plastic filters (left) and gelatin filters (right)*

Filter variety *Filters are made in a variety of materials, and are available in a wide range of shapes, sizes and lens fittings*

Multiple mounting *The holders for plastic filters allow several to be used together, even though this can lead to some loss of image quality*

Filters are very simple and basic accessories, yet there is a wide range of different types on the market and it can be difficult to choose between them. Even if you want only a standard yellow filter for darkening skies in black and white photographs, you may be confronted with three or more alternative filter materials and a dozen manufacturers.

While the practical differences between the various systems are often fairly clear (see pages 574 to 577), there is considerable confusion over relative optical quality. Some photographers buy only the most expensive, convinced that anything less will adversely affect the quality of their pictures. Others believe that there is little to choose between them. To discover just what the truth is, we ran a series of tests on a wide variety of filters.

The selection of filters tested included different colours from all price brackets and filters made from all the three principle materials—optical glass, plastic and gelatin. Most photographers buy medium-priced filters made by one of the leading independent manufacturers and the majority of the test filters came from their ranges. Nevertheless, we included filters made by one of the top camera makers and by one maker of cheap glass filters just to see how they compare.

All the filters were first subjected to a series of detailed laboratory tests to establish inherent optical quality and then fitted to a camera with a variety of lenses to see how they affected picture quality in practice.

Lab tests

Clearly, for high quality results, a filter must transmit the image with the minimum of distortion, so the main aim of the three lab tests was to compare criteria which might adversely affect the clarity

of the image.

Wedge test The idea of the 'wedge' test is simply to see if the two faces of each filter are completely parallel. If they are not, the filter acts slightly like a prism and blurs the image by causing dispersion of the colours. Wedging was detectable with all the filters and with the square plastic filters it was marked enough to make the other optical tests hard to perform. Fortunately, though, in no case—even with the cheapest filters—was wedging severe enough to significantly impair results in practice.

Interferometer test For the second test, we used an *interferometer* to show up aberrations with each filter. The interferometer is actually a very simple device that relies on a phenomenon called *Newton's rings*.

These are circular fringes of coloured light visible between two almost touching surfaces—you may see them on glass slide mounts where the film bows in the heat of the projector to touch the glass. They are produced by *interference* in the path of light waves through the two transparent surfaces and even minor aberrations in either surface are clearly visible. When each filter is placed in the interferometer, the changing patterns of colour fringing show up any defects very obviously.

Results were variable but most of the glass filters performed remarkably well. The only exceptions were the cheap glass filters which suffered from gross astigmatism—they also displayed distinct wedging effects. While the gelatin filters gave noticeably 'rough' looking fringes on the interferometer, with the better glass filters there was only minimal spherical aberration (see page 906). Spherical aberration is the spreading of focus produced by different areas of the filter—referred to as *zonal shift*. With the good glass filters, the zonal shift was never more than 0.0005 mm.

Surprisingly, the Nikon filters were slightly less consistent than the independent makes. Most consistent, and undoubtedly the best, were the Hoya optical glass filters which were good enough for use with an astronomical telescope. Unfortunately, it was difficult to test the Cokin filters on the interferometer, partly because of their wedging, and results were inconclusive.

Knife edge test The final and most revealing test in the laboratory was the *knife edge* test. Again the most important indicator of filter quality was the zonal shift caused by spherical aberration.

For the knife edge test, the filters were placed in front of a spherical mirror illuminated by a pinhole light source. The light passes through the filter and is reflected by the mirror and focused near the pinhole. By holding the edge of a knife at the focus and looking across the knife at the filter, we could find the variation in focusing distance—the zonal shift—produced by spherical aberration in the filter.

All the glass and gelatin filters did well in the knife edge test—even the worst gave a shift of barely 0.02 mm. Only at the very edges of the filters was there any marked zonal shift and since this part of the filter is only used with lenses of over 150 mm and under 24 mm in focal length, this will have only minimal effect in practice.

The results with the plastic filters were not so favourable. While there was no distinct zonal shift, the filters were obviously not uniformly clear and there was evidence of stretch marks—as though the plastic had been drawn out during manufacture. The general effect was of a rather blotchy light.

Dave King/equipment courtesy of Fujica & Mayfair Photographics

Practical tests

Having established the optical quality of each filter in the lab, we decided to perform some on-camera tests to find out whether these had any significant practical implications.

Studio tests to establish the effect of the filters on resolution we arranged a Paterson test chart giving a maximum resolving power of 80 lines per mm (see page 1074). Using an Olympus OM-1 camera with two Zuiko lenses—a standard 50 mm and a 75-150 mm zoom set at

150 mm—we photographed the test chart on Ilford Pan F film through each filter. For every filter, we made three exposures through each lens at slightly different focus settings and then made a series of exposures without the filters to act as a reference.

The film was developed in Acutol and examined carefully to determine the resolution achieved. Surprisingly, there seemed to be no significant loss of resolution with any of the filters, despite the variable lab results.

Pushing the test a stage further, we set up the camera with the standard lens at twice the previous distance from the test chart and examined the resulting image at the camera back with a microscope. With every filter, resolution was at least 150 lines per mm. Once more, none of the filters had any measurable defect, but some loss of contrast was evident through the plastic types and we thought that this might be severe if more than two are used together. To find out, we ran a series of location tests with the plastic filters.

Location shots We then moved outside and took a series of shots on Kodachrome 25 in the same Olympus OM-1, with an 85 mm Zuiko lens at *f*/4. An old church in bright light with a clear sky provided an ideal subject because it had a great deal of fine detail which could be lost with bad optical quality. The church porch was a combination of rather dark oak woodwork and finely cracked stone and clearly showed up any loss of definition or lack of contrast.

The shots through a pair of Cokin filters showed a slight loss of contrast compared with an unfiltered shot but this would only be noticeable with a giant enlargement. In a normal slide show, the loss of contrast would be virtually undetectable.

Another series of pictures of the church was taken with a filter which had been brushed with a wet finger which left a very slight, visible smear. This did show slight softening and lowered contrast, which would be noticeable, but still not seriously so. Nevertheless, it did bear out the importance of caring for filters and keeping them as clean and unscratched as possible.

Conclusions

After the results of all the tests had been analyzed, we concluded that even though some filters are not optically brilliant, all of them, even the cheapest, perform more than adequately. The difference between the best and the worst, when clean and unscratched, was minimal for all general photographic purposes.

Overall, the test results showed that none of the filters currently available degrade photographic results or contribute markedly to loss of contrast or sharpness. There was a note of warning from the test laboratory about the square plastic types being used in combinations of three or more. At least one maker produces an adapter so that two filter holders can be used together. This means that up to six filters could be used at one time, which could cause a significant loss of contrast.

For critical results Hoya seemed the most reliable. They are obviously polished in such a way as to produce very flat and parallel plates with high consistency. There is a slight qualification here in that the tests were carried out on 49 mm diameter filters. It is more difficult to manufactur larger sizes and with larger diameters larger errors could creep in. Generally, price did not seem to be related to quality to any significant extent.

John Mathers

Practical test *This church porch was chosen for its wide range of tones and fine detail. The first shot (above and top right) was taken without a filter to act as a reference shot for the others. The next shot (middle right) was taken with two plastic filters used together. The deterioration of image quality which has occurred can only be seen with the aid of a microscope, and for all practical purposes can be ignored. The last picture is softer due to smearing of the filter. This simulates the degrading of the image which can occur if the filter is damaged*

Test results

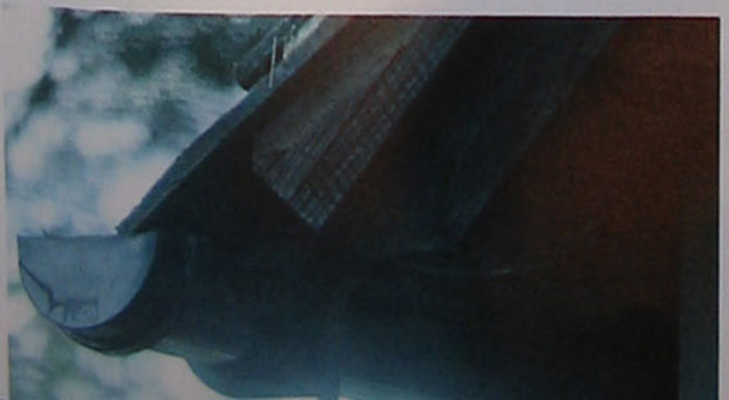
John Mathers

Hoya glass filter *This is the result of a test with a Fizeau interferometer which shows thickness variation. The circular, centred fringes mean that there is no 'wedge' in the filter, and that there are no irregularities in the shape of the filter edges*

Cokin plastic filter *This photograph shows the result of a knife edge test. The irregular shadows which can be seen across the square mean that the surface of the filter is correspondingly irregular. A perfect surface would produce a result with an even tone*

Hoyarex graduated filter *This is another knife edge test. In this case the lines which indicate faults in the filter run from top to bottom. This suggests that the plastic has been stretched in this direction, and this may have occurred during manufacture*

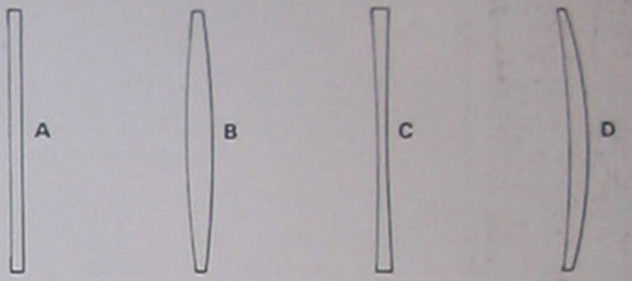
Nikon glass filter *The shape of the tones in this knife edge test shows that the filter suffers from some spherical aberration. But the smoothness of the shape means that this is well within acceptable limits and would not have any effect in practice*



John Mathers

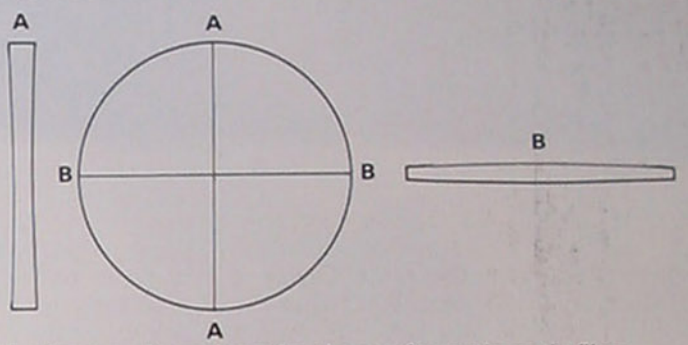
Filter faults

Filter shapes



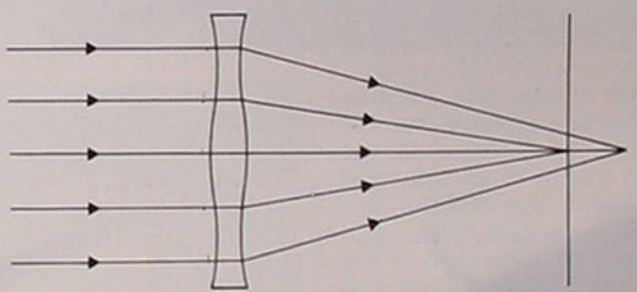
A *The ideal shape* **B** *Biconvex* **C** *Biconcave* **D** *Meniscus*

Astigmatism



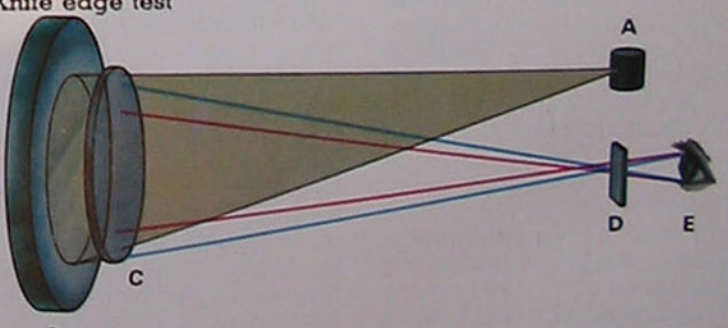
This diagram shows how the shape of an astigmatic filter varies. Cross section A is biconcave while B is biconvex, so lines at 90° to each other will be focused differently

Spherical aberration



Spherical aberration is produced by filters in a similar way to lenses. Parallel rays of light are brought to different focus points resulting in a general softness. This is not the same as a soft-focus filter which diffuses the light to create a slightly different effect

Knife edge test

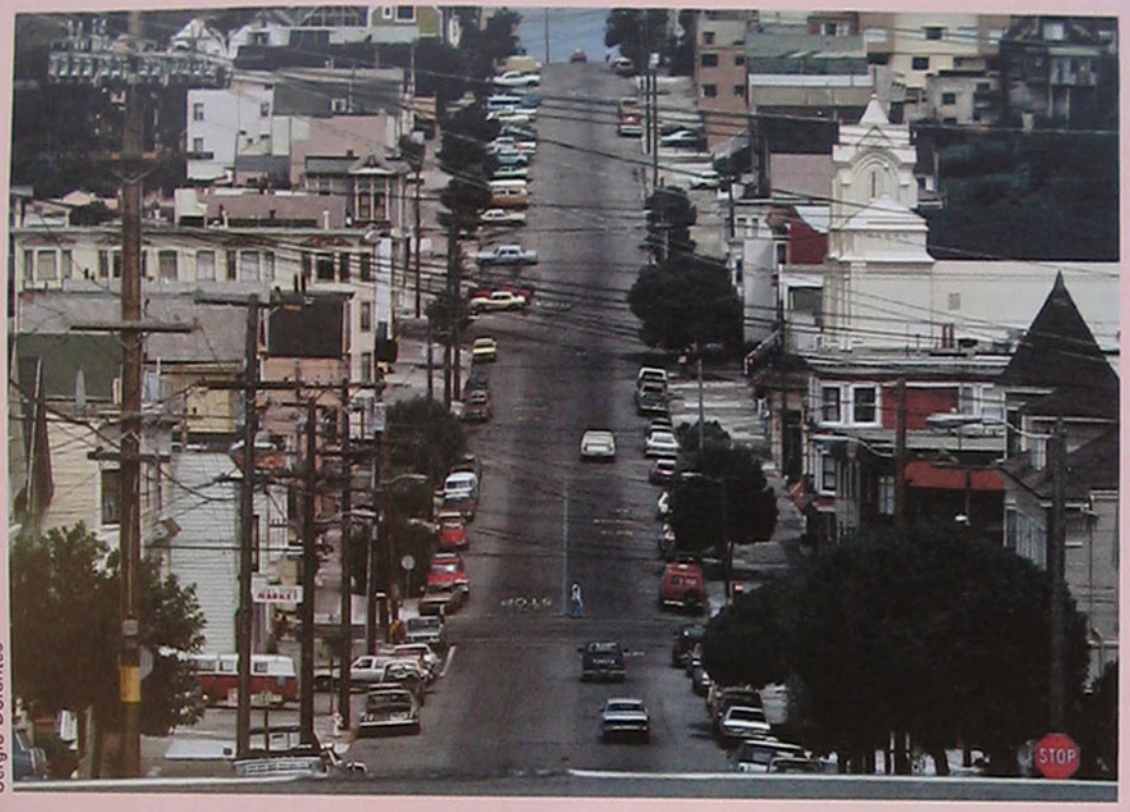


Light from a pinhole (A) is focused by a spherical mirror (B) at the knife edge (D), which, when moved, cuts off the light immediately if the image is perfect. But if the filter (C) shifts the focus point or introduces other faults, the darkening caused by the knife edge is gradual

Hayward Art Group

Depth of focus

Even the best lens will not give a sharp image unless the image is focused exactly on the film and the chances of this occuring depend to a large extent on the depth of focus



Sergio Dorantes

A high quality lens projects a sharp image but it will not give sharp pictures if this sharp image does not coincide with the film—if the image is formed either well in front or well behind the film, the picture will be blurred. Fortunately, it is not always necessary for the sharp image to fall exactly on the film plane because of a phenomenon called *depth of focus*.

The term depth of focus is often wrongly used in place of depth of field. Depth of field refers essentially to the subject, and the distance within the subject that is focused sharply by the lens. Depth of focus, on the other hand, refers to the image behind the lens: it is the extent of the sharp image projected by the lens.

Unlike depth of field, which is generally large and measured in metres, depth of focus is very small and measured in millimetres, or even fractions of a millimetre. It allows some tolerance in focusing, and, perhaps more important, in the positioning of the film, though the latitude is not very large.

Sharp centre *Depth of focus ensures that, even if the film is slightly curved, the centre of the picture will still be sharp, as shown by the enlargement (left)*

Star trails *During long time exposures, the film surface may bend slightly, giving defocused star trails*

As the lens is stopped down, depth of focus increases. Large format cameras tend to be used with small apertures, and the larger film size allows for a larger circle of confusion (see page 963). So the depth of focus with these cameras is usually quite large, and this allows the film plane to be moved in order to alter the depth of field and control perspective (see page 778).

The depth of focus increases when the lens is focused on close objects. This is because the lens is moved away from the film to focus on subjects closer than infinity. As a result, the position of the maximum permissible circle of confusion also moves further from the film plane. This is different from depth of field which is smaller at close distances.

Practical value

The fact that depth of focus is greatest at close distances and small apertures can be very useful. For example, when making big enlargements with the lens well stopped down, the masking frame can be tilted to give some correction for converging verticals while still giving a sharp overall image.

When the lens is at full aperture, depth of focus is very small. Although this makes it harder to achieve perfect focus, it can also be useful for the technique of *rear focusing*, for example.

Rear focusing is valuable with large format cameras, or other cameras attached to bellows units. Normal focusing is achieved by moving the lens and this changes not only the lens to film distance but also the lens to subject distance. The result is that magnification is altered as well, and this can be quite noticeable in macro work. Rear focusing works by moving the film plane, and so changing only the lens to film distance. Changes in sharpness are quite abrupt, and so focusing is easier. This technique is most successful with shorter focal length lenses since depth of focus increases with longer focal lengths—again unlike depth of field.

Robin Scagell

A basic formula allows depth of focus to be calculated. This shows that for a 50 mm lens, focused on infinity, with an aperture of *f*/16 and a maximum circle of confusion of 0.03 mm, the depth of focus is 0.96 mm. When the aperture is increased to *f*/1.4, depth of focus is reduced to only 0.084 mm. This has great practical significance. It means that the distance from the lens to the film must be kept accurate to this amount if large aperture lenses are used. The cost of precision cameras is, in part, due to the care and accuracy used in their mechanical assembly and tolerance testing. Perhaps the most important aspect is keeping the film in position. It is also important that interchangeable lenses are accurately aligned every time they are fitted to the camera.

Film flatness

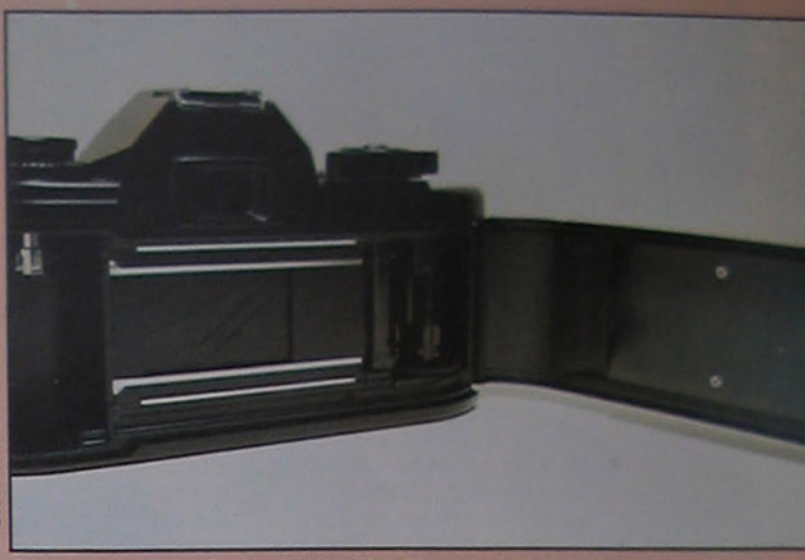
Photographic film has an unfortunate tendency to curl. This can be due to either natural curvature caused by the layer structure, or to the way some film is stored, tightly coiled in a cassette, just prior to exposure. If the film is curved during exposure, parts of the picture will be unsharp, as not all of the film is in the focal plane. Depth of focus helps to overcome this problem by extending the areas of sharp focus. But it is also important to keep the film relatively flat.

This is usually achieved by providing a shallow channel in which the film lies, and a pressure plate to hold it in this channel. However, the channel, formed by the use of guide rails, is often around 0.2 mm deep. And as the thickness of film base is typically 0.13 to 0.15 mm, the film may still be slightly bowed against the pressure plate. Fortunately, most lenses give an image that is slightly concave, and this may correspond approximately to the shape of the film.

The larger the film area, the more difficult it is to keep flat. An oversprung pressure plate may cause marks or scratches on the film surface as it is advanced over rollers in the camera.

Film cartridges of the 126 and 110 type do not allow the camera to have a pressure plate since they are self-contained. For this reason the film in such cartridges is not very flat and so large aperture lenses are seldom used. Limits of *f*/5.6 and *f*/11 are common for 110 and 126 cameras respectively so as to give good depth of focus and ensure sharp pictures.

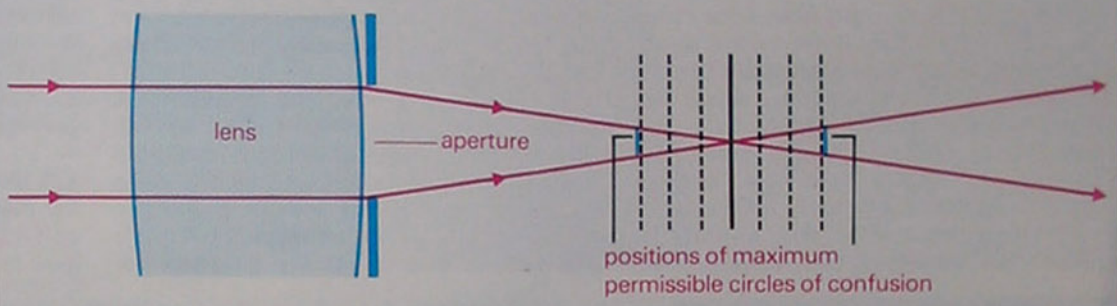
Large format cameras using dark slides have similar problems. Fortunately the depth of focus is correspondingly greater. For instance a standard 150 mm *f*/5.6 lens for a 5 × 4 inch camera has a depth of focus of 1.12 mm at this aperture assuming a maximum circle of confusion of 0.1 mm which is normal for this format.



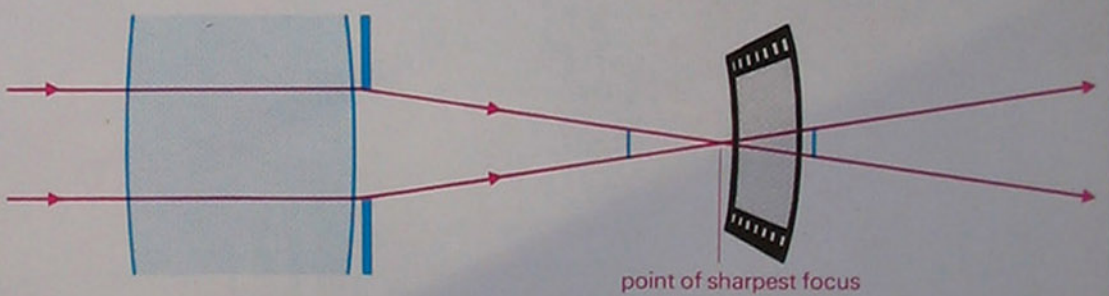
Steve Mansfield

Pressure plate *To keep the film flat most cameras have a sprung pressure plate incorporated in the camera back*

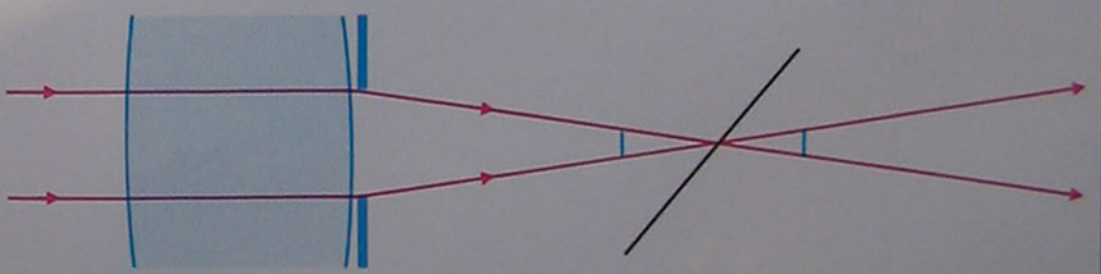
Practical applications of depth of focus



Film position *Depth of focus allows some latitude in film positioning—the limits are determined by the positions of the maximum circles of confusion*



Film curvature *Even if a pressure plate is used, the film may still curl. Depth of focus prevents this from causing unsharpness in parts of the image*



Camera movements *Some cameras allow the film or lens panel to be tilted in order to control depth of field, and depth of focus keeps the whole image sharp*

Hayward Art Group

Indoor sports

With careful choice of viewpoint and a little preplanning, you can overcome the technical problems of shooting action indoors and begin to exploit some of the drama and excitement of indoor sports events

Put off by the technical problems of shooting in difficult lighting conditions, many photographers steer clear of indoor sporting events. Yet for the tremendous range of action subjects—the glamour and gore of the boxing ring, the grace of the gymnast, the breath-taking speed of an ice hockey match and much more—it is well worth overcoming any apprehension about technicalities and accepting the challenge of capturing the drama and excitement on film.

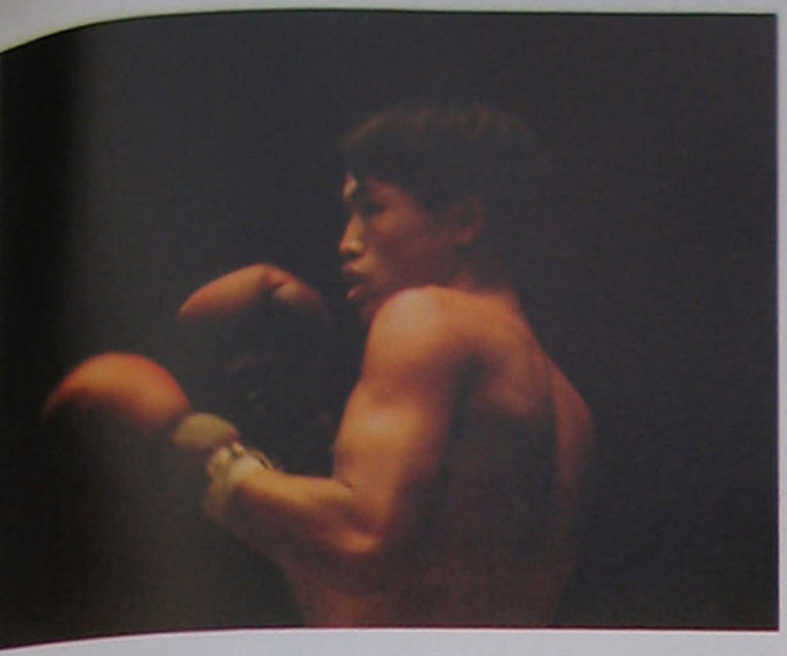
As with outdoor sports, it is useful to know a little beforehand about the rules and the way the play flows in the event you wish to shoot. It is especially important with indoor events to work out exactly where all the action will take place and choose your viewpoint accordingly. Space can be limited indoors and there is usually little chance to move around after the event has started. In basketball, for instance, all the drama takes place around the baskets—a seat in the centre of the pitch might give a good view of the game but is a poor position for photographs. If you are able to, go to the hall or arena a few days earlier and spend a little time trying out various viewpoints with alternative lenses.

Some indoor sports are almost impossible to photograph successfully. Squash is a case in point because the players are nearly always playing away from you and your viewpoint is inevitably from above. Squash courts also use fluorescent lights which give a green cast to colour pictures.

At outdoor events, the professional sports photographer normally has an advantage over the amateur because he has greater access to the action. This is less true with indoor events. Even at a world championship boxing match there are very few seats at the ringside for photographers. This area is taken up by sports writers and television commentators. However, you can use this to advantage in your shots by including the crowd in the composition to provide more atmosphere. The boxing ring is brilliantly lit and you can use the first few rows of people in silhouette as a natural frame for your shot. However, the professional photographer can set up shots with the athletes before the event or during training. Unless you have very good contacts you will not be allowed near a world class athlete during training. Nevertheless, there is no reason why you should concentrate on professional events. There can be just as much drama and excitement at

Ice hockey *Keep your eyes open for an incident or argument during any sport, and frame tightly, using a telephoto lens to isolate the main action*

Leo Mason



Michael Freeman

Guido Alberto Rossi/The Image Bank

Boxer *Normally unacceptable, the deep shadows and orange cast of poor tungsten light can convey the drama of the event*
Fencer *In practice sessions, you can arrange a striking, opponent's eye view of the fencer in action*

amateur events and you should be able to get a far better viewpoint at the local indoor sports centre. It may even be possible to arrange a meeting with the club secretary to outline the sort of pictures you would like to take. In fact, the secretary may be very receptive to the idea of a set of pictures which can be used for publicity.

During an amateur practice session you often have the chance to get the participants to repeat certain activities for your camera. You will also be able to work in locations which would be out of the question during an actual event. It is far better to have a great picture of a relatively unknown athlete than a shot of a champion who may be too far away to be recognized.

Another advantage of shooting at amateur sessions is that you may be allowed to use flash, something that is normally absolutely prohibited at major events. If you are able to arrange a session with a gymnast, try to pick viewpoints that not only illustrate the tremendous effort that they put into their exercises, but also show them in a way that they are never normally seen. If you are using flash, keep it as a fill-in and allow the main area lights to create a rim around the subject so that they stand away from the background. Even so, it is worth moving around until you have a dark and uncluttered background.

In particular, pre-arranged shots give better results than action shots with the martial arts. In both judo and fencing, the action is very jerky and it may not be easy to take anything but straightforward shots of the action. But if you can organize a session with the fencers you could, for instance, put yourself and your camera in the place of the opponent. In this way, the fencer and sword appear to be coming straight at you, and you can convey something of the real feeling of taking part in that event. A session at a martial arts club will also allow you to take pictures from floor level. From this position, you could use a wide angle lens with the camera pointing upwards at the judo expert who appears to be towering over you.

In most sports there are similar picture opportunities before and after the event. A carefully set up portrait can be very rewarding. Boxers and the people connected with boxing are often colourful and flamboyant figures, making good subjects for portraits. Straightforward shots against a plain background can be very effective. With the boxers themselves, try to arrange the pictures after they have finished a bout so that their skin glistens with perspiration—or cheat with baby oil to achieve the same effect. Remember though, that with some portraits, the nature of the sport may not be immediately evident and the shot loses some of its impact. Try to include the 'tools of the trade' to set the shot in context. With a cyclist, make sure the bicycle is in the frame: shoot an ice-hockey goalkeeper in full body armour, holding or wearing his face mask.

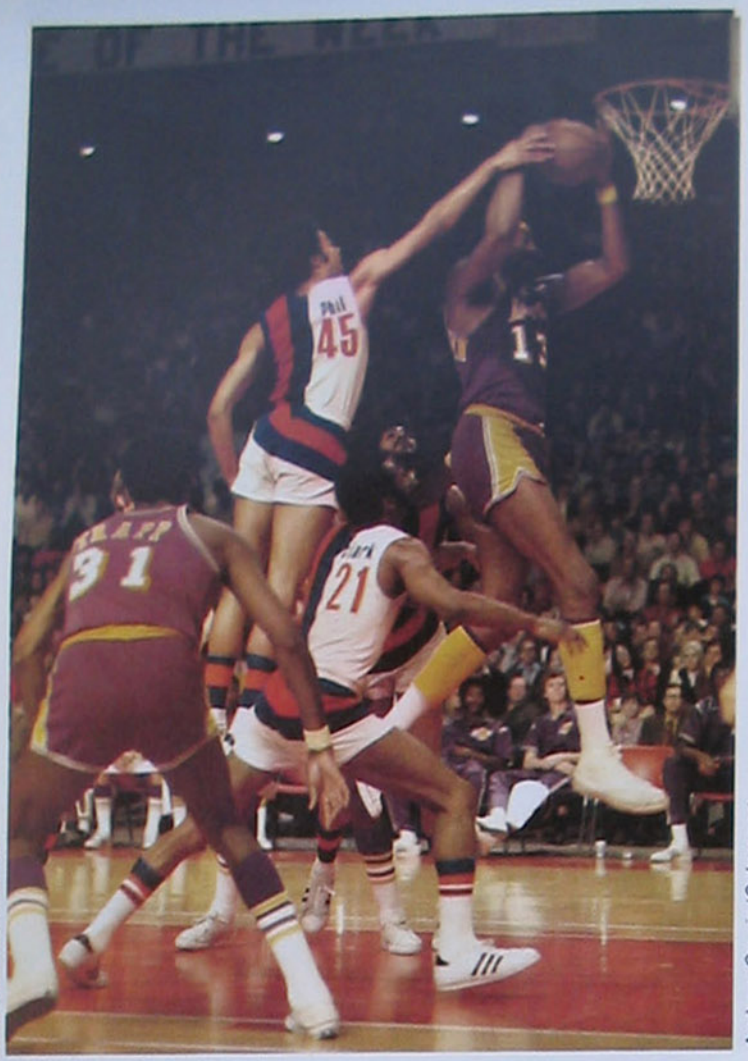
Of course, during events light is a problem. The light level is seldom sufficient to allow you to use your camera's full capacity for freezing the action. Most professional photographers take a full range of films with them on an assignment, but the most popular films are probably the 200 and 400 ASA (ISO) transparency types which can be pushed by two stops, giving speeds of 800 and 1600 ASA respectively.

Colour balance, however, can be more difficult to achieve—particularly where there is a mixture of daylight and artificial light. It is essential to identify the nature of the light source. If you are in doubt, ask the organizers what type of lighting the hall uses. When the event is being televised or is coming from a venue that is often used for television, artificial light may give correct colour balance for daylight film since television cameras need daylight balanced light.

Whatever the lighting, though, be sure you have your camera at the ready all the time, particularly at the moments when the action has just finished, because often the best shots are momentary, unexpected incidents. The look of elation or dejection on the face of a weightlifter who has either succeeded or failed with a difficult weight may say much more than pictures during the activity.

There is a tendency to assume that sports shots must freeze the action and many people shoot at high shutter speeds all the time. But sports with graceful movement provide the oppor-

Harlem Globetrotters *For basketball, a position near the basket is essential. Try to capture the moment the ball leaves the player's hand as he leaps and shoots*
High dive *At amateur events, you can often find unusual and effective viewpoints, but remember to keep the composition simple. Here, the pool provides an ideal background*
Cycling *Choose your technique to suit the character of the event—slow shutter speed shots capture some of the speed and excitement of a six-day cycle event*



Ronald Ross/Colorific

Andrew Cowie/Colorsport

Leo Mason

Steve Powell/All-Sport

tunity to use slow and even very slow shutter speeds to capture the flow of the action and the balletic movements of the competitors. Both skating and gymnastics particularly benefit from this approach.

With the camera mounted on a tripod, you can use exposures of up to a second and the free flowing movements can give very graceful abstract shots. Some care is needed with ice skating since the skaters move very quickly around the ice. It is best to pick a moment when the subject is moving on the spot. Slow shutter speeds can also be very effective with the martial arts on certain occasions. If you anticipate the action carefully, you should be able to start your exposure as one of the participants begins to make a throw. The long shutter time records the whole of the subsequent movement.

At a cycling race you can mix flash with a long exposure, freezing the cyclist with the flash and showing the speed of the event by the blur created by the long exposure.

Multiple exposure techniques (see page 513) are similarly effective with indoor sports—providing you can ensure a dark background. A simple shot of a gymnast performing on the parallel bars or on the beam can show the whole exercise.

For every kind of shot, though, look carefully at the background. Since a large aperture is often needed in the poor light, the background can normally be thrown out of focus. Nevertheless, look out for distractions and try to exclude them from the frame. Move higher for instance, so that the floor becomes your background—this is particularly useful with a sport such as skating where the crowd can be visually very distracting.

Think of the subject in the context of the background—certain backgrounds complement the subject better than others. A fencer in his white outfit stands out well against a dark background, whereas a coloured boxer does not. With some events the background can be a great help, particularly if it has a strong graphic element. At major weightlifting events, for example, the weightlifter performs in front of the scoreboard with all the competitors' names on it and the various weights they have achieved. With this in the background you have a picture that tells the whole story.

If possible, allow the various competitors space to move into in your composition. You may find that this will only come with experience, since composing a picture carefully while following a moving sport is not easy at first try.

Stewart Fraser/Colorsport

Gymnastics *A small detail can sometimes capture the flavour of a sport much more effectively than a general shot*

Colin Elsey/Colorsport

The jump *Lighting in an arena can intrude on the composition, but you can make a feature of this by using a starburst filter*

Remote control

When the ideal viewpoint is either inaccessible, impractical or even dangerous, you may still be able to take the pictures you want using one of a wide variety of remote control techniques

In some situations, it is not possible for the photographer to stand by the camera ready to release the shutter at the right moment. It might be too dangerous, as in the case of a rocket launch, or the subject might be too timid, as in the case of wildlife photography.

In these and many other situations, some way of releasing the shutter from a distance is needed. Any camera which has provision for a cable release can be triggered mechanically from a short distance. Those which can be fitted with motor drives, however, can be operated by a number of remote control methods, even at considerable distances.

Steve Powell/All-Sport

Over the water *You cannot always be close to the action at an athletics meeting, and remote control may be the solution. For this dramatic effect, the camera was fitted with a fisheye lens, and fired with an infrared device*

Mechanical methods

The easiest way of releasing the shutter at a distance is to use a long cable release. Although this is the simplest solution, the frictional resistance of the cable limits its length to about two metres. Another system is the pneumatic release, in which the shutter is released using a long rubber tube filled with air, with a plunger at one end and a bulb at the other. When the bulb is squeezed, the air pressure in the tube is increased, which forces the plunger outwards and releases the shutter. This method allows the photographer to work at a greater distance from the camera, and the tube can be up to ten metres in length.

Both methods are reliable because of their simplicity, but they have certain drawbacks which make them unsuitable for certain situations. Apart from the important limitations on the distance from photographer to camera, there is the problem of winding the camera. Unless you fit a motor drive or a winder to the camera, you have to wind it manually after each shot—this means moving up to the camera. Fitting a motor or a winder might seem to be the solution, but, in most circumstances, a cable cannot give fine control over the number of shots you take.

More elaborate remote control systems allow the camera to be operated from a much greater distance, but they are harder to arrange and may be less reliable than mechanical methods.

Electrical control

Using an electrical system, you can operate the camera at almost any distance, and it is cheaper and simpler than the majority of long distance remote

Jerry Young

Self-portrait at speed *Clamping the camera to a vehicle can give impressive results. Here, the camera was released by an electric switch connected to the motor drive by a cable. To give an impression of speed, the shutter was set at 1/60 sec. A 16 mm fisheye lens was used here, but a 24 mm or 28 mm wide angle would also have been suitable*

On the swing *The cable operating the camera was taped to the monopod. For a simple shot like this, either a cable or a pneumatic release would be suitable*

control systems, since all it consists of is a piece of cable connected to the motor drive or winder. Most motor drives have a facility for electrical operation, consisting of two electrical terminals. The remote control cable is simply plugged into the terminals, and when the photographer closes the circuit by means of a switch at the other end of the cable, the motor drive or winder fires for the period of time the switch is kept on.

Most manufacturers supply cables for use with their motor drives and winders, but you can easily make your own using ordinary lightweight flex soldered to a suitable plug and an ordinary switch. Lightweight flex is adequate for lengths up to about 35 m, but beyond this length resistance becomes too great and thicker cable should be used.

Electrical remote control has the advantage of economy—the cable, plug and switch can be bought for very little. It is the ideal system when the camera is fairly close to the photographer but is inaccessible, such as when it is bolted on to a canoe, a racing car or a hang glider. In these cases, the camera is operated by the pilot or driver—often, solitary sailors use this system to photograph themselves on lone ocean crossings.

Unfortunately, this method of remote control has the disadvantage that there must always be a cable between camera and photographer. This not only makes it difficult to set up in certain circumstances, but it restricts the photographer's mobility. In situations where the camera is visible but inaccessible an infrared system is better.

Infrared control

Infrared systems, which cost roughly the same as a good medium telephoto, depend on an infrared transmitter, rather like a flashgun with a deep red filter over the window, which transmits a powerful infrared pulse when the switch is pressed. The pulse is picked up by the infrared receiver which is usually mounted on the hot shoe of the camera. This operates a solenoid, closing the circuit and switching on the motor drive or winder. It is best to direct the transmitter towards the camera as far as possible, though precise alignment is not always necessary.

Some powerful sources of infrared, such as the sun, might fire the remote control system accidentally. For this reason, many infrared releases emit more than one wavelength, or quality of light, not all of them infrared. The receiver is 'tuned' to these light frequencies, and does not respond to any other combination. Some types of release have two or more frequencies or 'channels', allowing the photographer to operate more than one camera independently, using the same set.

Different systems work in slightly different ways, but the popular Nikon Modulite can operate in two modes. In the first, one press on the release button starts the camera and a second press stops it. This is ideal for sequences such as a 100 m sprint, which lasts little more than ten seconds. The camera can be started at the beginning of the race and left running to shoot the entire event. You can then select the best shot, or sequence of shots, from the film. For a wildlife photograph, however, when the action takes place over a long time, you do not want the camera running continually and the second mode is more useful. In the second mode, you shoot a single frame each time you press the button on the infrared transmitter.

Infrared releases are efficient up to

Camera on the wing *Remote control is essential for this type of shot. The camera and motor drive were securely clamped to the wing of the biplane, and fired electrically by the pilot. A 16 mm fisheye lens was used to obtain maximum depth of field and give the characteristic distorted effect*

the photographer is stationary.

Unfortunately, though, there are other problems associated with radio remote control. First, radio frequencies are strictly controlled by governments, and private devices of this type are illegal in some countries. In Britain, for example, ready-made radio controlled units for operating cameras are illegal, though custom built units can be licensed, and operated legally in certain areas.

Second, radio waves abound in built-up areas, and the camera can be easily

about 60 m in most built-up areas, though this is reduced in open country. Mist, rain and snow all absorb infrared, reducing the range of the system. However, you can increase the range of your transmitter by fitting an improvised lens system to it. A cardboard snoot with a converging lens on the end, fitted to the window of the transmitter, can increase the range to as much as 90 m. Initially, a little trial and error may be required to achieve the right arrangement. With luck, though, you can operate the camera away across the far side of a fairly wide river.

Infrared release systems do have a number of drawbacks, however. The first is that if two units of the same type are used at the same event by different photographers, the signal from one unit can start the other running. Though the choice of frequencies does get round this to a certain extent, it does not rule out accidents, and there have even been cases of photographers deliberately winding off the film of rivals using a compatible release. The only solution to this problem, which at some sporting events can be a real obstacle, is to have your unit specially modified to operate on a unique frequency. Manufacturers cannot do this, however, and it should only be attempted by a technician.

The other problem is that, over a long distance, infrared releases are limited to line-of-sight operation. This means that the transmitter and receiver must be exactly aligned, with no obstacle in between. If this is not done, the camera will not fire at a long distance. At shorter range, however, some infrared releases, notably the Nikon, can be operated by bouncing the beam off suitable reflecting surfaces.

Radio control

The problem of line-of-sight operation is solved by using a radio-controlled release. These function in the same way as a walkie-talkie radio. A transmitter sends out a signal at a given frequency, which is picked up by a receiver mounted on the camera, firing the motor drive or the winder. Such systems can work efficiently at much greater distances than either electrical or infrared releases, and are ideal for use when the camera is fixed to a moving object but

Lions *A Nikon Modulite was used for this wide angle shot—the receiver is clearly visible, mounted on the hot shoe of the camera. The lion, attracted by the whirring of the motor drive, knocked the tripod over and chewed the camera which, fortunately, was almost undamaged*

Bike *Shots like this are simple to set up. Tape the monopod to the bicycle frame and pre-focus the lens—here, an 18 mm—on the child. As the bike goes past, the infrared transmitter (inset) fires the motor drive. To obtain an impression of speed, use a 1/60 second shutter speed to give a blurred image*

all photographs by Jerry Young

Bird table *When the camera is invisible, infrared cannot be used, and radio control is the answer. The receiver (inset) is mounted on the camera and can be triggered from several kilometres*

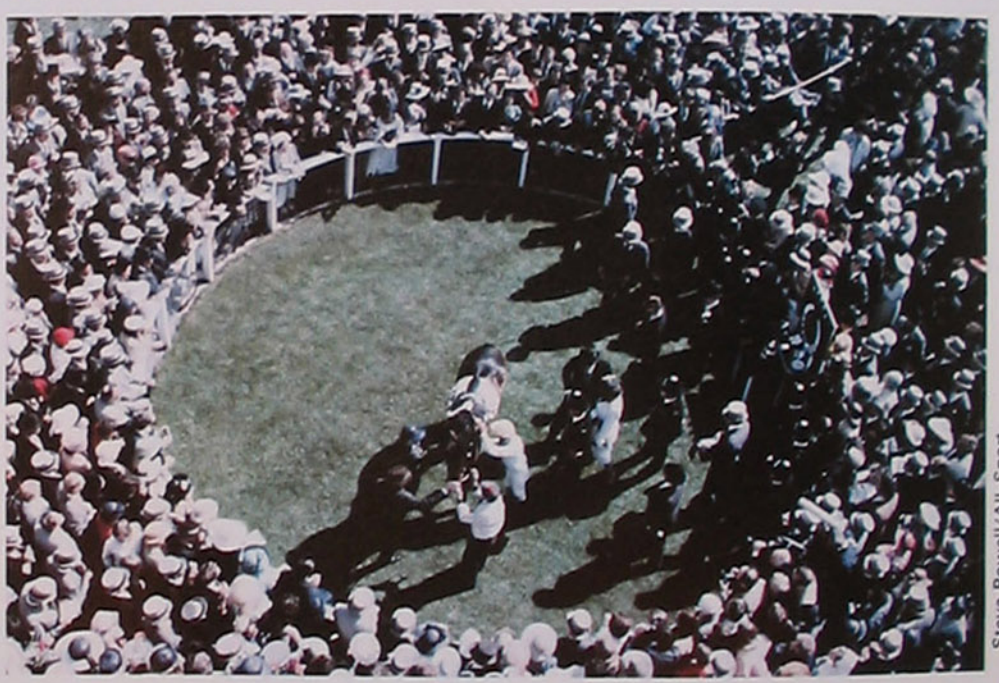
fired by outside interference. Even vehicles can generate radio waves, so this can be a real problem if you want to operate your camera near a road or in a busy city centre.

If for some reason you need to use a radio release in a country where, for legal reasons, they are not available, you might be able to adapt a device manufactured for use with model aircraft. These are usually very compact, and can be bought for little more than the price of a camera body or a mid-range medium telephoto lens.

Automatic detection

Sometimes, the photographer cannot even observe the subject or release the shutter at the right time. A typical example is wildlife photography. To photograph a bird at night, the camera must be positioned according to the bird's habitual flight paths, but the photographer cannot see the subject.

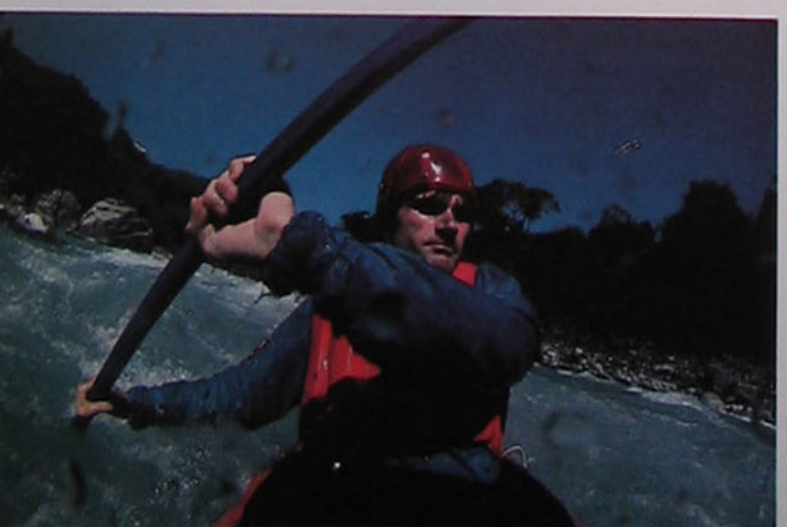
This is where systems designed for surveillance and security are the only solution, since no purpose built photographic equipment of this type is available. A common device is a transmitter which gives out a continuous infrared beam, and a receiver. When the



Steve Powell/All-Sport

White water *A specially constructed waterproof box attached to the canoe held the camera and motordrive, while a special switch, placed between the canoeist's legs, fired the camera when he squeezed his knees together*

Derby winner *Remote control allows some unusual viewpoints—here the camera was at the top of a pole, and operated by infrared. Careful framing and prefocus are required—a moderate wide angle lens also helps framing*



Jerry Young

Pilot *The close viewpoint and a wide angle lens gave this shot added impact. In situations like this, the photographer cannot control the camera. Here the pilot operated the unit with a hand switch*

beam is broken, an electrical circuit is completed and this triggers off the camera. The two units, transmitter and receiver, can be mounted side by side, and the beam bounced off a reflector. Some devices incorporate a rotating fan, as on a strobe light, which breaks the beam up into a fixed rate of pulses. If the beam is broken or the frequency changed, the camera is fired.

This system is ideal for use in daylight if the weather and lighting conditions are constant and the subject slow moving. However, if the light is changing rapidly or the subject needs to be frozen in motion, you must use some form of flash. Not only is lighting then consistent, but the flash is sufficiently short to freeze the action.

There is a short time lag between the breaking of the beam and the release of the shutter, so you must frame your picture to allow for this. On most 35 mm cameras, the delay can be as much as 1/10 of a second, but on some cameras with leaf shutters it can be as little as 1/400 of a second. A leaf shutter can also be synchronized at high speeds, allowing you to use flash to freeze action even in daylight using a wide aperture.

Another factor is the sensitivity of the unit. Most units have a screw which adjusts their sensitivity to a given size of subject. If you want to photograph a small bird, you must set the sensitivity so that insects do not fire the shutter. Similarly, if your intended subject is much larger, set the sensitivity lower, or the camera will take many pictures of smaller creatures.

When working outdoors, make sure all your equipment is well wrapped in polythene to keep it dry. Conventional power supplies will probably be inadequate, especially if you are using flash—a very small area of undergrowth may need several guns to light it properly, so even a large source of power can be quickly exhausted. The best solution is to use lead acid batteries. Motor cycle cells give the right voltage, and several of these set up in series can power a remote release device for the best part of a night.

Exposure

The 'break the beam' system used with flash at night allows complete exposure control, but most other remote control situations are more complex. Often, the camera has to be set up a long time before the event to be photographed.

Automatic exposure is not necessarily the best solution. If your camera has aperture priority automation, you might set it to obtain an acceptable shutter speed for a given light. If, however, that light diminishes, your pictures will be blurred, because your camera will have compensated by setting a slower shutter speed.

Whether you use your camera on automatic or on manual, the only solution to the problem of exposure is to compensate at the processing stage.

Bear in mind that, however efficient your remote control system is, it is always a good idea to use it, whenever possible, only as a back-up to a camera operated manually.

David Hosking

Frozen in flight *A flash of 1/10,000 second freezes rapid movement. Eight flashguns, of which four are visible on the left, were used to light this small area of undergrowth. A transmitter, at the top of the picture, directed an infrared beam at the receiver on the ground. The bird, released through the tube on the right, flew through the beam, activating camera and flash in 25 milliseconds. The camera was a Hasselblad with a 150 mm lens*

Liquid emulsions-2

With liquid emulsion, you can print pictures on a wide variety of surfaces. Techniques for preparing the emulsion and surface are described on page 1274—here is how to apply the emulsion and print your picture

Gavin Cochrane/Debbie Prowse

Chrysanthemums *Slightly rough textures, such as this hand-made paper, make particularly good surfaces for liquid emulsion prints*

Once all the preparations have been made—with the emulsion mixed and tested and the support 'subbed'—you can coat the surface with the liquid emulsion and make your picture.

There are various methods of applying the liquid emulsion coat but all operations must be carried out under proper safe-lighting conditions. To avoid skin contact, wear rubber gloves at all stages in the process, particularly when using commercially manufactured liquid emulsion—this usually contains phenol, a chemical that can burn your skin.

With all methods, though, the emulsion must be applied in liquid form in a thin even layer. An even layer is important if the image is to be of even density throughout. By keeping the emulsion coating thin as well, the image can take on the texture and colour of the support.

Start by placing the container of emulsion in a bowl of very hot water to melt the emulsion down. When the stock solution has melted, pour off only what you require for your immediate needs—an eggcupful will cover a surprisingly large area when spread out to the proper thinness. Be careful not to shake or stir the emulsion as air bubbles can be produced—these will cause extra problems later on. Of course, if you apply the emulsion to a cold surface, it immediately cools down and becomes unmanageable. Unfortunately, you can rarely prewarm the surface without destroying the subbing and surfaces that feel cold to the touch—highly conductive materials such as metals and ceramics—must be subbed with polyurethane varnish rather than the normal material so that prewarming is unnecessary. Warm feeling surfaces such as wood can be subbed normally and used at room temperature.

If the emulsion is to be coated on to a very small object, you can just quickly dip the object into a pot of the emulsion and then let it dry in a cool, dust-free air flow. If the surface is rigid, like a ceramic plate, coat the surface by pouring a small quantity of the liquid into the middle of the plate. Spread it quickly with your finger tip, and tilt the plate in all directions to get an even coat. Any excess can be poured off from one corner before the emulsion sets, and returned to the storage container. Tap the coated object on your work surface to break any small

surface air bubbles, and allow it to remain flat, in the dark, for 15 minutes.

After 15 minutes, the emulsion should become tacky and, if necessary, you can speed up the drying process with a fan or hair dryer set to cold position, taking care not to blow particles of dust on to the sticky surface—you may find it better to let the emulsion dry naturally overnight in a light-tight drawer or cupboard.

When coating a smooth, flat surface, you can spread on the emulsion with a straight blade rather longer than the surface to be coated. A plastic ruler is adequate, but ideally you should use a thin metal blade. Try to ensure that the blade will pass over the surface to be coated with a very small clearance by placing a raised shim on either side of the area—the thickness of the shim determines the coating depth.

To make the coating, pour a small pool of the emulsion on to the surface at one side of the area, then sweep the blade across it smoothly. The emulsion will spread out into a thin even layer.

Alternatively, you can apply the emulsion with a brush, a spreader, or a

Fabric printing *You can use liquid emulsion directly on cloth, but is better to use special cloth sensitizer*

rechargeable type aerosol spray. With brushes, though, the brush marks tend to show in the emulsion, so you should use a brush only when the surface is fairly rough textured—such as paper or wood—although you may wish to create a brush mark effect on smooth surfaces to give a painted effect.

If you do use a brush, make sure it has fine bristles. Melt a little emulsion, and apply it using as even a brush stroke as possible. Allow the emulsion to set, but before it dries apply a second coat at right angles to the first. If the emulsion is too sticky to brush smoothly, or starts to set too quickly, thin it by adding a very small amount of hot water.

The most reliable way of coating a surface, however, is by spraying. Rechargeable aerosol sprayers intended for model makers are suitable for small areas. These inexpensive sprayers have a jar for holding liquid, a spray head, and a disposable can of propellant gas. Spraying must be carried out in a warm and well ventilated room under suitable safelight, and it is advisable to use a face mask to absorb any vapours.

To prevent clogging the spray nozzle, dilute the emulsion with water—40 per cent by volume—and warm it to about 40°C. Tap water is normally good enough but if you are making a bulk mix to store for any length of time, use distilled

Coating the emulsion

1. *Where subbing is needed use a five per cent gelatin solution for 'warm' objects, and varnish on 'cold' ones*

2. *Place the emulsion storage container in hot water to melt the emulsion. Use a water bath rather than direct heat*

3. *Pour off only what you require for your immediate needs, otherwise you risk fogging what is not used*

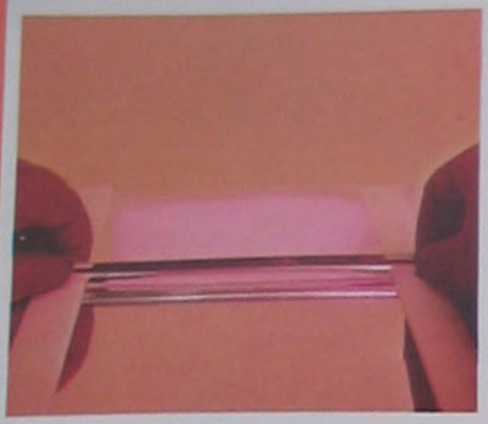
4. *'Cold' objects like plates must be warmed to prevent emulsion coagulating before the excess is poured off*

5. *Rough textured surfaces should be coated using a brush. Use light strokes to prevent brushmarks*

6. *To coat a smooth, flat surface use shims—such as tape—along either side, then pour emulsion between them*

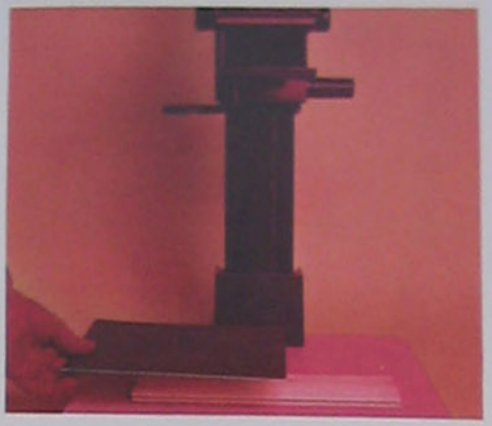
Gavin Cochrane

continued



Gavin Cochrane

7. *Before the emulsion has a chance to set, use a straight edge such as a ruler to spread the emulsion between the shims*



8. *Exposures tend to be very long, so start with a broad range of test times. Precise timing is not necessary*

9. *Small objects can be processed almost as if they were ordinary prints. Large objects can be swabbed with a sponge*

water to dilute the emulsion

Place the object face upwards, on a piece of newspaper, and near to the safelight for good illumination. Spray from an angle of about 30°, moving left to right across the surface. When this first coat has been applied, allow it to set for a couple of minutes and then apply a second coat from top to bottom. The coated items should be stored in total darkness in a dry and warm atmosphere for between 12 and 24 hours until thoroughly dry.

To prevent the emulsion in the sprayer setting between coats, unscrew the jar from the sprayer and place it in a small bowl of warm water to maintain the emulsion temperature at up to 40°C, and dip the spray unit into warm water to wash any emulsion out of the nozzle and suction tube before it gels.

When you have finished, tip any remaining emulsion in the jar back into your storage bottle using a small funnel and thoroughly wash out the spray unit and jar in warm water. Remember to coat a couple of small samples of the base material so that you have some test strips to establish exposure when you make the print.

Exposure and processing

Liquid emulsions are not generally very sensitive, and exposure times are normally four to eight times that needed for an equivalent enlargement on printing paper. For a 20 × 25 cm enlargement from a 35 mm negative, start with an exposure of around 60 to 100 seconds at *f*/5.6 and make a test strip in this exposure range. After processing, estimate the correct exposure, making a second test exposure if necessary, and then expose the coated material or object for the correct time.

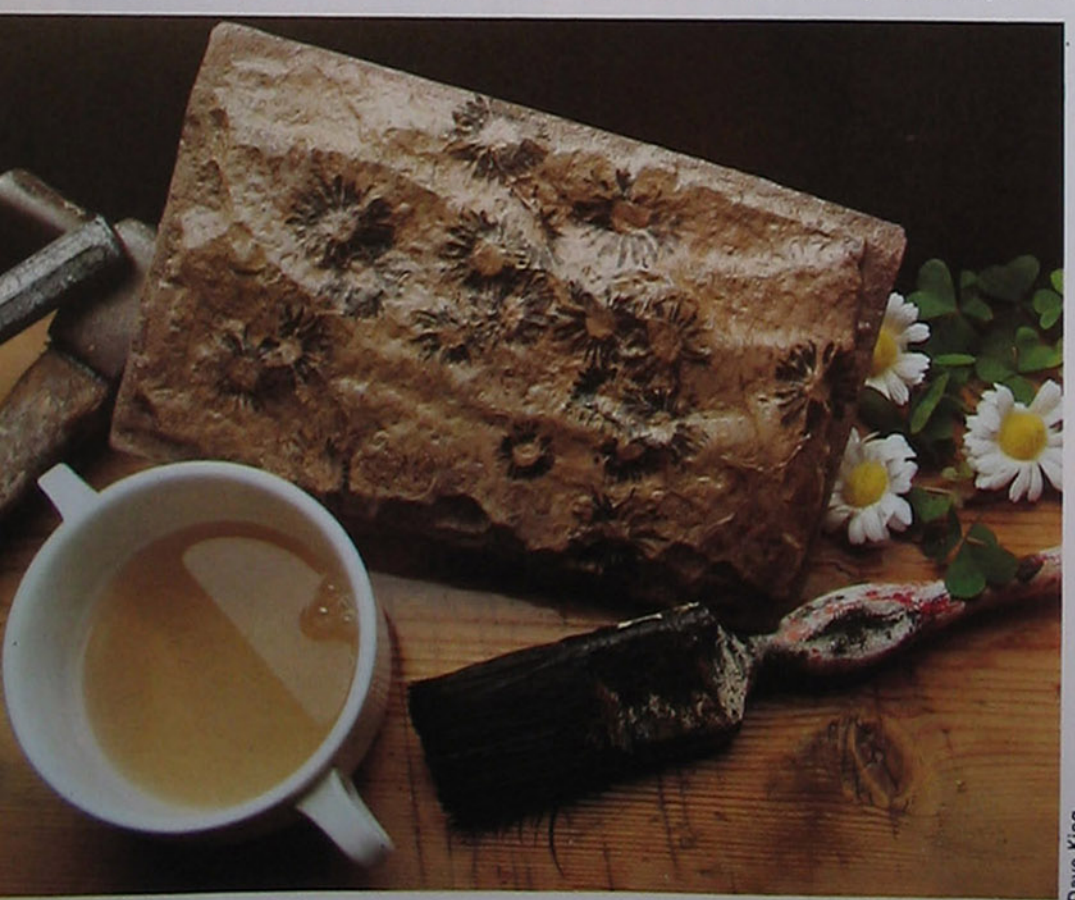
You can process the emulsion in dishes in any normal photographic paper developer following the same basic processing steps. It is important to use an acid hardener fixer, however, as liquid emulsions are rather soft. Because the emulsion is rather thick, the fixing time must be extended up to about 15 minutes. Be careful when using an acid stop bath because it may dissolve some objects, especially eggs. If you have any doubts about the chemical stability of the material you are printing on, make tests before you start by dipping an uncoated sample of the material in your processing solutions. Watch for any bubbling, or discolouration of the object. If the object reacts with the processing solutions, it must be coated with clear varnish before you apply the emulsion to the surface.

After fixing, wash the object like a normal print, but take extra care to avoid 'frilling' of the emulsion, which is still rather soft at this stage. If the base is very absorbent, use a hypo eliminator.

When washing has been completed dry the picture carefully in gentle heat and then treat the surface with print lacquer or polyurethane varnish to protect the image.

If you wish to make multiple images you can expose and process the first image, and, after drying, re-coat the object, give another exposure and process again.

If the results obtained are not to your liking, and you wish to use the surface again for another attempt, simply wash the emulsion off with hot water and gentle scrubbing, dry the material and start the process again.



Dave King

Brick print *This porous facing brick was first subbed, then coated with home-made emulsion. A transparency was used to give a negative image of daisies which look like fossils*

Dave King

Grainy portrait *Planks of wood offer tremendous scope for experiment. Wood takes emulsion and subbing coats well, and can be used in many ways*

unusually shaped surfaces—small three-dimensional objects like eggs are suitable for dipping in a pot of liquid emulsion, as are small shells or pebbles.

Another approach is to match the picture to the surface—printing a picture of trees on to wood, for example. In this case the choice of wood is important. Use a light wood for a landscape scene, a darker wood with a more pronounced grain for a more sombre mood picture.

Another suitable surface is brushed aluminium which is very effective with some types of subject, but this material must be subbed properly first.

The only surface that does not lend itself readily to the use of liquid emulsion is cloth. Since it is not rigid the emulsion tends to crack with the flexing of the cloth, although a little glycerine added to the emulsion prior to coating can increase its flexibility. However, if you wish to print on cloth, for example to put a picture on a teeshirt, then it is preferable to use a fabric sensitizer. There are many formulae available for making your own, and a fabric sensitizer is also marketed by the same company that markets Liquid Light emulsion (see inside front cover part 47).

Special uses and effects

A normal negative can sometimes give results that appear to be a little flat and grey, especially if the emulsion is very fresh. Sometimes it is better to use a fairly high contrast negative, or even one made on lith film but developed in a normal negative developer. If you have the choice, work from a colour slide and use this to make a black and white negative of fairly high contrast, or make one to the size of the final picture so that it can be contact printed on to the chosen material.

In general, the more graphic the picture the more interesting it is and a strong picture gives a more pleasing result when printed on various unusual surfaces rather than one that contains fine detail and soft tones.

If the base surface you want to print on is not flat, a large negative could be wrapped around the object before exposing so that the image is sharp and undistorted. Otherwise, you must use a very small lens aperture to get sufficient depth of focus and this leads to impossibly long exposure times.

When you have tried using your liquid emulsion on one or two different surfaces you may feel it is time to experiment and to try and produce some pictures that are a little out of the ordinary. Try printing pictures on

Dave King/Peter Truckel

Stained wood *Another feature of making prints on timber is that you can colour the image using wood stains or food dyes. Alternatively, use diluted watercolour repeatedly to build up a colour*

Assignment

Thai temple

A Buddhist temple is full of intricate details which work together to create a great impression on a visitor. The problem is to photograph them without causing a disturbance to others

The richly adorned Buddhist temples of Thailand are some of the most striking features of the Far East. The ornate designs in jade and mother of pearl, the solid gold statues and the offerings of gold leaf pressed on to favourite objects by devout worshippers can make a very deep impression on the outsider. Photographer Michael Freeman found the temples so fascinating that he decided to tackle an assignment in Bangkok, concentrating on the details which make these places so awe inspiring.

One of the chief difficulties, however, is that the visitor cannot expect to be at liberty to wander around a temple photographing any features which strike the eye. With people worshipping at all hours of the day, the photographer has to remain unobtrusive, always being careful to respect the customs and traditions of the country and its people. This means that equipment such as tripods or flash guns are usually out of the question and alternatives have to be improvised. The same applies all over the world whether it is a church, a mosque or a cathedral.

Michael's solution to this problem was to make extensive use of 400 mm and 180 mm lenses while he was photographing the interior of the temple. With these focal lengths he found that he could reach remote details of the roof or tackle close-up shots of the Buddhas without having to move around very much. To avoid attracting attention by using a tripod, Michael steadied the camera and lens by either leaning against a wall or by resting the equipment on top of a soft camera bag. To use this improvised means of support more

Michael Freeman

Head of gold *Michael used his 400 mm f/5.6 telephoto to isolate this gold head. Since it was only illuminated by tungsten light, the pleasing warm glow enhanced the colour of the gold*

Mother of pearl *Shots like this have to be absolutely sharp to reveal the intricate craftsmanship. Handholding a 180 mm lens at 1/30 second meant taking several shots to be certain*

Dancer *Once again the 180 mm lens was fitted and since Michael used slow film, he had to choose a moment when the dancer was still. 1/60 sec, f/5.6*

Arched shrine *This detail was high up in the ceiling so a 400 mm lens was needed. Leaning against a wall allowed a shutter speed of 1/125 second*

Gold leaf and flowers *These are offerings made to a favourite statue. The mixture of daylight and tungsten light made the shot warm in colour without looking really orange*

Monk *When the light was really dim, Michael used Ektachrome 400. Even with this fast film, the camera had to be steadied to allow a 180 mm lens and a shutter speed of 1/30 second*

easily. Michael found it best to remove the prism from his Nikon F2 camera body so that he could compose his shots by looking directly down on to the viewing screen. For the more dimly lit corners of the temple, there was no opportunity to use Kodachrome so some shots were taken on Ektachrome 400.

However, even if you can cope with taking shots with a minimum of light, a further problem usually arises when using daylight film like Kodachrome or Ektachrome in artificial light. But in this case, Michael decided not to worry excessively about problems of colour temperature. Generally, he found that subjects like the gold leaf and the solid

gold statues benefited from the warmer tones created by this light. He has found that Ektachrome 400 seems to be balanced to cope with fairly warm light since it is frequently used as an indoor film.

In addition to the ornamentation of this particular temple, Michael photographed a monk whose serene air seemed to match the atmosphere of the surroundings. He also photographed a group of dancers who were acting out morality plays. The selection of shots shows what can be done by not trying to include the whole place in a single shot but by concentrating on details to convey the mood of the temple.

Michael Freeman

Row of Buddhas *Low light also meant limited depth of field, but when shooting objects in a row you can often produce interesting effects without everything in focus*

From a distance *One of the shots taken of the whole temple was from another building using a 400 mm lens to give it prominence*

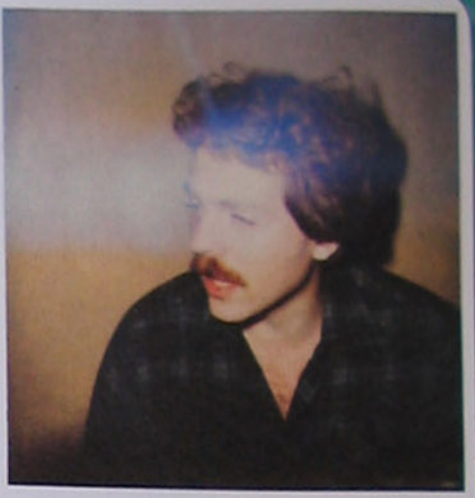
Reclining Buddha *Using a 20 mm ultra-wide angle lens, Michael managed to achieve dramatic foreshortening of the pillars, framing the head of the Buddha between them. Apart from the pictorial effects, this also gave a sense of scale*

What went wrong?

Instant picture problems-1

Instant picture cameras can produce very good pictures if you accept their obvious limitations. But to get the best out of your camera, you must learn from your mistakes . . .

When you use flash in fairly bright light, be careful that the camera does not move during exposure–after the flash has fired, but while the shutter is still open briefly, a second, blurred image may be formed (left). With auto eject cameras, be careful not to obstruct the film's exit as this may mark or jam the film (right)



If your flash produces the 'hot spot' effect, where the picture is brighter at the centre than the edges (below left), either use a diffuser placed over the flash, or isolate your subject within this area. Some flashguns can be taken off their mounting bracket and redirected for better lighting of close-ups, but ensure that flash coverage is even (centre). Uneven illumination can be a problem if you use flashbars for close-ups (right)

The sequence of pictures below represents the full range of manual override possible on the automatic exposures given by a typical instant picture camera. Even at each extreme some sort of picture is obtained, although only the 'normal' setting can be described as truly acceptable. However, you may find the quality of pictures you obtain can be improved by making gradual adjustments to the lighten/darken control

DILSTON
HALL

Assignment

Portmeirion

Portmeirion is a popular photographic subject—but is it possible to find new pictures in a village that has already been photographed by almost every visitor that goes there?

Trevor Wood

When he arrived at Portmeirion, Trevor Wood felt fairly confident that he would get some good shots. Portmeirion itself is a surprising and picturesque location —an Italianate village in sunny colours set on the rainy Welsh coast beneath the forbidding mountains of Snowdonia. The fantastic creation of the architect Sir William Clough-Ellis, its eccentric collection of various styles of architecture has proved to be very popular with movie makers and it seemed to have great potential for the still photographer.

But things began badly. The dull, overcast day made the place appear less than picturesque, taking on the appearance of a faded film set. It seemed as if much of it was a facade with nothing behind—all fake texture in hardboard and plaster. Trevor spent three or four hours walking around scouting for likely shots, all the time hoping that the light was going to change.

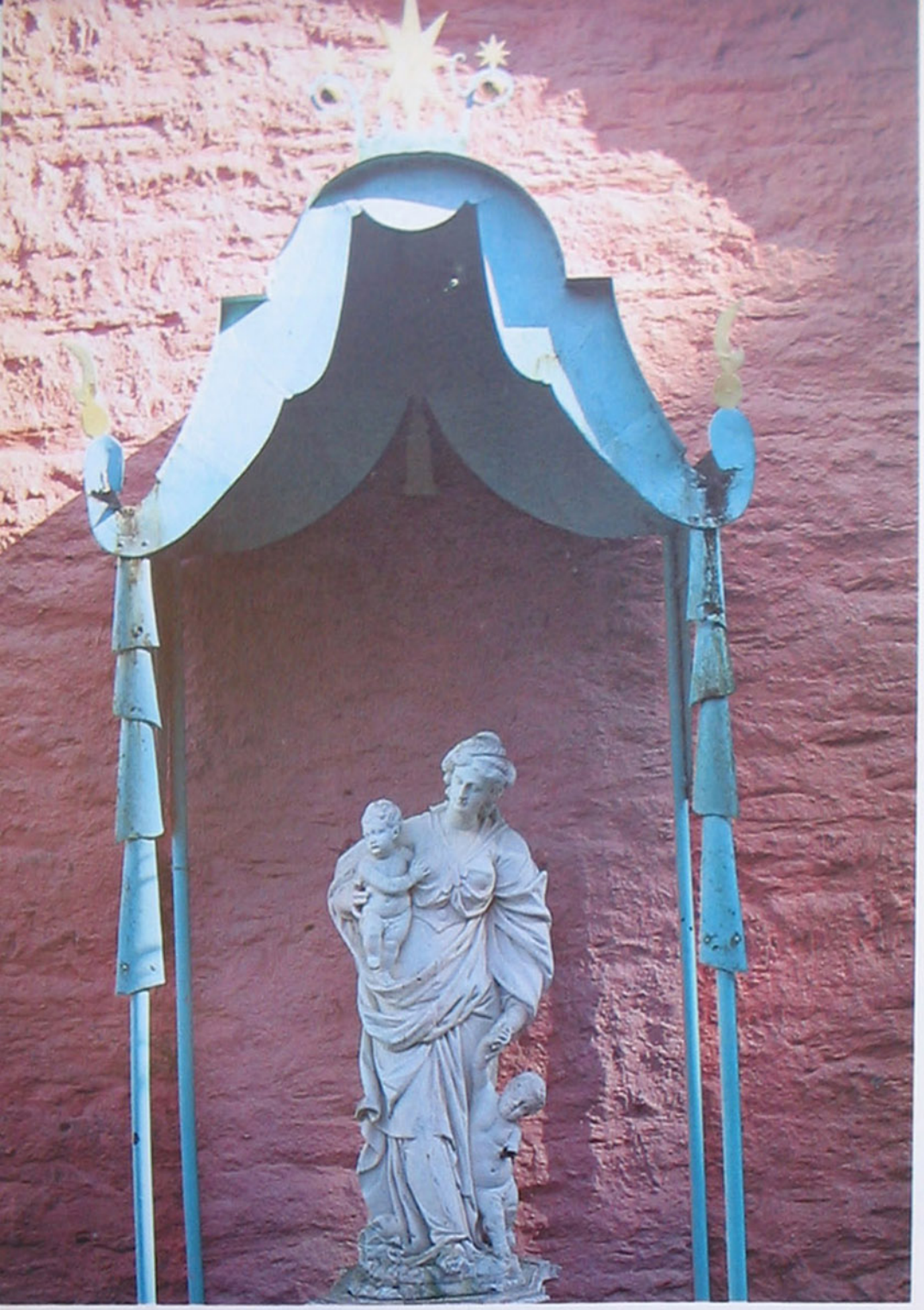
When, in the early evening, the sky eventually brightened and the light became stronger, the film set awoke and the general appearance became more convincing. While this light lasted, Trevor photographed many of the features that he had noticed earlier.

One thing that became apparent was that the grounds are laid out so that they look their best from specific vantage points. The place was also very cramped and when Trevor tried to move away from these predetermined viewing positions, the compositions became very cluttered. To some extent he had to give in to this predictability, and he knew that these locations must have been seen in many other photographs—in postcards and visitor's snapshots. So he also tried to make his own personal interpretation of the location by isolating details which interested him and by trying to find less obvious angles.

The arched gateway is an example of the way the place is designed. It is an obvious and contrived view which must have been seen many times before. And yet it is a shot which is hard to ignore and which Trevor felt obliged to take in order to provide a full photographic account of the place. He took the shot, taking care over composition and technique so at least it was a good version of a standard scene.

Empty street *For much of the day this street looked just like an abandoned film set but Trevor's patience was rewarded by the low evening light that brought the scene to life. He used an Olympus OM-2 with a 75–150 zoom and Kodachrome 64 transparency film*

Although he generally prefers to use Ektachrome 64 colour transparency film, for this assignment Trevor also used some Kodachrome 64. There are slight differences in contrast and colour saturation between the two, but he finds no noticeable differences in definition. Often any obvious differences between the two films is usually the result of the processing quality.



Shrine *This structure looked rather fake—being made of hardboard—but fortunately, the sunlight made it more attractive and brought out the texture of the wall which contrasted with the smooth wood (35 mm lens and Ektachrome 64).* **Rooftops** *An overall view of the place was hard to find but Trevor managed to include a group of picturesque buildings with his 35 mm lens. He used Ektachrome for this—since it is less contrasty than Kodachrome, it was more suitable for the even tones of the scene.* **Painted head** *A 200 mm lens and tripod helped to isolate this head. A low viewpoint made it possible to use a plain background and the contrast of Kodachrome turned the out of focus are a rich black.* **Old couple** *A 75–150 zoom framed this couple nicely between the wrought ironwork*

Figure on the balcony *Although the plaster statues seemed obviously photogenic, a straightforward shot could have been dull so Trevor included a yellow bush in the frame but kept them deliberately out of focus. A 75–150 mm zoom helped tight framing.* **Overgrown window** *The foliage which had grown over the walls of buildings added a feeling of authenticity to the place and Trevor exploited this in many of his subjects. The greenery also provided contrast with the faded colour of the wall (35 mm lens and Kodachrome 64).* **Archway** *The architect of Portmeirion provided many fascinating vistas that seem to invite the photographer, and though obvious, they can make attractive shots. Trevor invariably found that if he tried to vary these preconceived viewpoints, the compositions tended to become cluttered and unattractive (35 mm lens and Ektachrome 64 film)*

Trevor Wood

Improve your technique

Using polarizing filters

A polarizing filter need not be used solely for the elimination of reflections—it can also help to darken skies, or add colour to a dull photograph

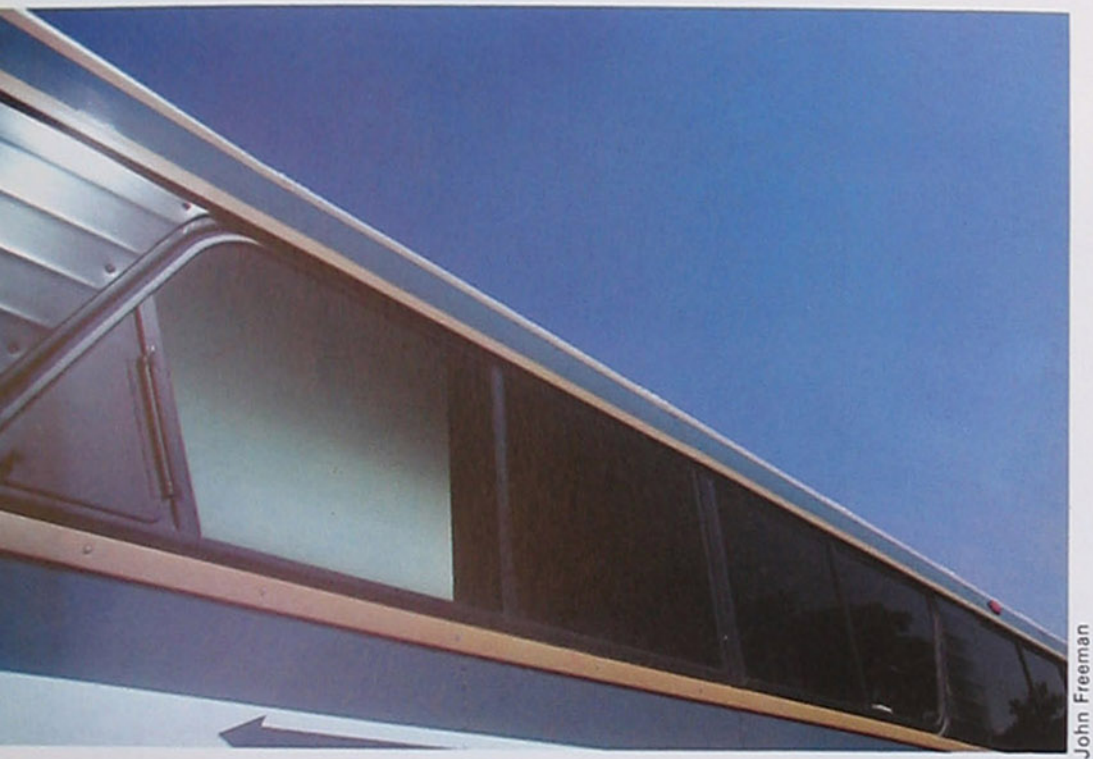
Many pictures can be ruined by the glaring *polarized* light reflected from shiny surfaces such as plate glass and water. Polarizing filters reduce or remove this, without substantially affecting the colour balance of the shot. They can also be used to darken a blue sky to give the shot more impact.

The nature of polarized light and the principle of the polarizing filter are fully dealt with on page 1030. There are, however, a number of techniques you can use to control the effect of the polarizing filter on each shot. By adjusting the filter on the lens, you can cut out varying degrees of the sheen or gloss given off by highly reflective surfaces, which 'dilutes' colours and can mask texture. Some shiny, polished surfaces give off strong, specular reflections, and these can be almost entirely suppressed by the polarizer.

In landscapes, haze can weaken colour, especially on the horizon on sunny days. While this is sometimes desirable for certain effects, when not needed it can be reduced by the polarising filter, giving better colour.

Polarizer technique

The best way to judge the effect the filter will have on your shot is to look directly through the filter itself, either through the viewfinder of an SLR



John Freeman

Sky and bus *Light from a blue sky is strongly polarized and you can use a polarizing filter to deepen its colour*

Dave King

Brilliant bridge *A vari-colour polarizing filter can be used to produce several different effects—simply by turning a ring, its colour can be changed dramatically*

camera or by holding it up to your eye.

Rotating the filter has the effect of cutting out light polarized in different planes. When the plane of this polarized light is at 90 degrees to the filter's plane of polarization, the filter's effect is greatest—it cuts out the maximum amount of polarized light. This is useful when, for example, you want to darken the sky in a shot. Most polarizers have a mark on the rim, and when this mark is lined up to point at the sun, the filter's plane of polarization is at 90 degrees to the plane of polarization of the light from the sun. The sky is thus darkened as much as possible.

However, since light in any given scene is polarized in many planes and it is not always possible to work out what these are, you can get the surest idea by looking through the filter itself. Rotate the filter until you obtain the effect you want, bearing in mind that there is no point in rotating it more than 180 degrees, since the range of effects is repeated every half turn.

Dave King

Leaf and car *Vari-colour polarizers affect polarized light differentially. Here, the colour of the car windscreen has been changed by rotating the filter*

Brightening colours

Glossy non-metallic surfaces give off polarized light, which is not the colour of the surfaces themselves but the colour of the incident light, usually white or bluish white. This effect obscures the real colour of the surface which will not appear saturated or bright when photographed. All but completely rough or matt surfaces reflect some polarized light, but it is normally only a problem with shiny surfaces such as leaves, paint, pavements in the rain, polished surfaces, leather and skin. By rotating the polarizer to cut out as much as possible of this sheen, you can render the true colour of your subject much more clearly and brilliantly and perhaps avoid unpleasant burnt out highlights. Professionals, for example, use a polarizing filter when photographing furniture, to show the grain of the wood more clearly. Be careful not to overdo correction, though, for some subjects need the sheen to retain their original sparkle.

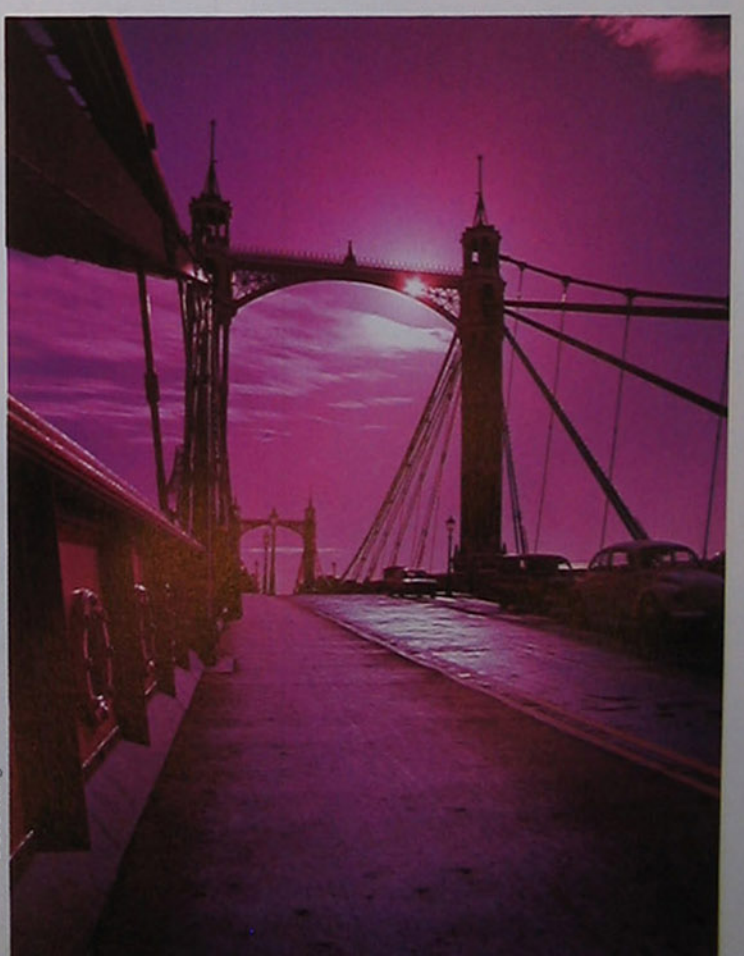
Reflections

Sheen is usually diffused and subdued —reflections are much more noticeable, and can be very undesirable in certain shots. Polished paintwork, plastic, glass and water all give off strong reflections which may hide their colours almost completely. Such reflections can be reduced or even removed by a polarizing filter, but it cannot suppress the reflections in mirrors or polished metals such as chrome.

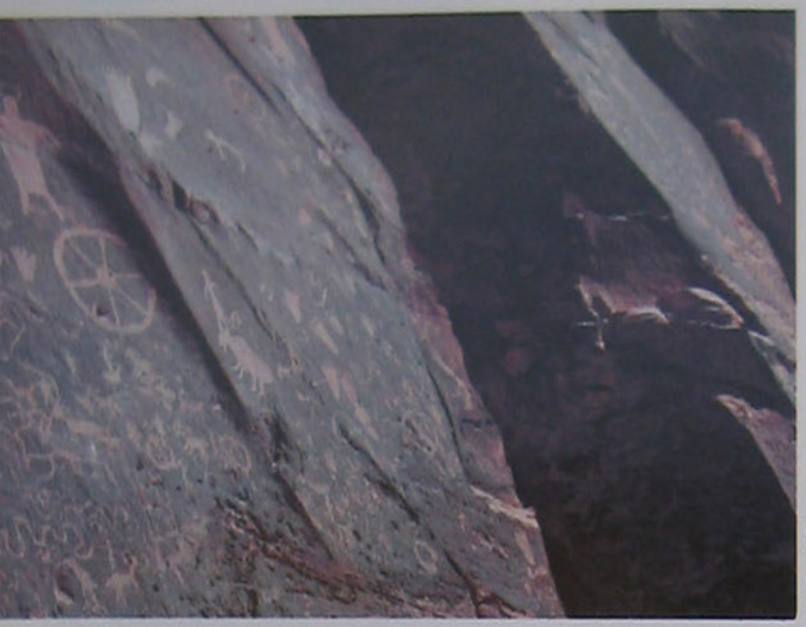
The effectiveness of a polarizer at suppressing reflections depends on the angle of the lens relative to the reflecting surface, and what this surface is composed of. Every shiny substance has an optimum angle, and if light is reflected off its surface at this angle, the reflected beam is completely polarized. This has a number of practical implications.

If you are trying to completely remove reflections from a shop window, or from a still pool of water, for instance, it means that you must point your camera at the surface at a very precise angle. For water, this angle is 53°; for plate glass, it is 56°. If your lens is pointed at the surface at this optimum angle, and the polarizer rotated carefully, every trace of the reflection disappears in the centre of the field of view. At the edges, where the angle of the reflected light is slightly different, elimination of reflections is not so complete, but usually this is noticeable only with wide angle lenses.

Although the angle between lens and surface is critical, it does not need to be accurately measured. Simply by looking through the viewfinder and moving the camera back and forth, you should soon pick out the best angle at which to aim



Dave King



Michael Freeman

Cave paintings *Unwanted reflections from very shiny surfaces can be removed very effectively with a polarizing filter*

the lens.

Since a polarizing filter is only effective within quite a narrow range of angles, roughly at a diagonal to the reflecting surface, its usefulness is limited. If the camera is being pointed directly at a window, for example, there is no point in using one, as its ability to cut reflections is negligible.

If you are photographing moving water or a rough sea, a polarizer is not very useful either, because the water surface is constantly being broken up by waves. With still or gently rippling water, however, a polarizer can totally remove reflections.

When cutting out reflections from polished surfaces, watch out for stress marks which show as coloured areas. Windscreens show bands of colour, and some plastics show marks which are not visible when they are photographed normally.

Darkening the sky

Polarizing filters can be used to darken the sky, on bright, sunny days when the sky produces large amounts of polarized light. In some colour shots without a polarizer, the sky can appear to be almost white, rather than blue, but when a polarizer is used this effect is greatly reduced and skies can be very deep blue.

The amount of polarized light in the sky varies according to the angle of the sun. Areas at right-angles to the sun contain the most, so the filter has its greatest effect when the view is at right-angles to the sun. The final result therefore depends on the season and the latitude as well as on the direction in which the camera is aimed. When the sun is high, the filter affects the area of sky nearest the horizon—when the sun is low, on the other hand, the areas of sky overhead are darkened most.

With a wide angle lens, however, you may easily include areas of sky with differently polarized light. Consequently the filter's effect is not uniform across the whole picture area, and the result is often visibly artificial and far from pleasing.

Normally you will find that the filter setting which darkens the sky most also removes other unwanted effects such as sheen or reflections from the ground or water, and a single setting provides all the effects you want.

Haze

Light scattered by dust and moisture in the atmosphere, causing haze, contains a proportion of polarized light. This haze can sometimes be reduced by a polarizing filter, allowing you to bring out elements in a landscape which would otherwise be lost. Again, do not be indiscriminate in using the filter, but consider whether the landscape really benefits by the inclusion of the haze.

When there is just a slight haze in the distance rather than a definite mist, try using a polarizer and a UV or haze filter together. Because it cuts out some of the stray light which causes distant haze, the filter brightens up the colours of the scene generally. No polarizer alone can completely elminate haze of this kind, as it does not have much effect on the long range blue rays cut out by the haze filter. Some polarizers, however, have their own UV/haze cutting elements built in. Exposure can be long with this set-up, because the filter factor is considerable, so you might try using a tripod to avoid camera shake.

Exposure

Because a polarizer cuts out some light rays, it has much the same effect as a neutral density filter, and so you must increase the exposure by about one and a half to two stops.

Anne Conway

Uneven sky *With a polarizer and a wide angle lens, the sky may appear on film as a patchy, uneven shade of blue*

With most cameras incorporating TTL meters, calculating the extra exposure is no problem but some cameras incorporate beam splitters in their exposure meters. When these are used with a normal polarizing filter, they may give totally wrong readings because the beam splitter reflects light partially, and polarizes it at the same time, blacking out or boosting the reading.

With this type of camera, use a circular polarizer. This filter has one component which acts in the same way as a normal polarizer, but also includes another sheet which gives the light rays a 'twist' as they leave the filter, so that instead of vibrating in just one plane they travel in a spiral. They then pass through the beamsplitter without giving a false reading.

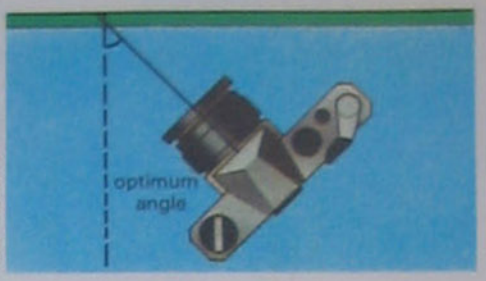
With slow films, long exposure times are almost certainly necessary with all but the brightest subjects. If you plan to do a great deal of work with slow colour films, you would do well to invest in the best quality polarizer you can find. It might gain a whole stop more than you would get from a cheap one.

Additionally, high quality polarizing filters absorb all colours of polarized light equally, but you may find that a cheap filter does not. In practical terms, this means that instead of eliminating the reflection of the sun on a pool of water, you merely colour the reflected image a deep shade of purple. An inexpensive filter may, therefore, be a false economy.

Special techniques

Two polarizers combined, rotated independently of one another, act as a neutral density filter which can vary from ND 0.9 to nearly clear (see page 280). When they are rotated to darker settings, they often produce a strong blue colour cast.

Colour polarizers are available which turn the different polarizations of light into different colours. For example, a red–blue colour polarizer such as the Hoya vari-colour looks purple in appearance. Light passing through it polarized in one plane emerges coloured blue, while light polarized at 90° to it comes out as red. Unpolarized light comes out purple.



Paul Williams

Critical angle *For best results, move around until the polarizer is at the correct angle to the reflecting surface*

A colour polarizer combined with a normal polarizer produces a variable colour filter. These are normally made to give a single colour filter with continuously variable density.

By combining a two colour polarizer such as the red–blue mentioned above, with a plain polarizer, you produce a filter which has variable colour instead of variable density.

Although polarizing filters are only effective when light is reflected from the subject at one specific angle, there is a technique that can be used in the studio to totally eliminate reflections, whatever the relative position of surface and camera.

This is to use polarizing material over both the light source and the lens. This system is ideal for irregular, highly reflective subjects such as varnished oil paintings.

Large sheets of polarizing material are stretched over the light sources so that all the light that falls on the subject is polarized in the same plane. If the lights are hot, as is the case with tungsten lighting, or studio flash with modelling lights, special heatproof material must be used.

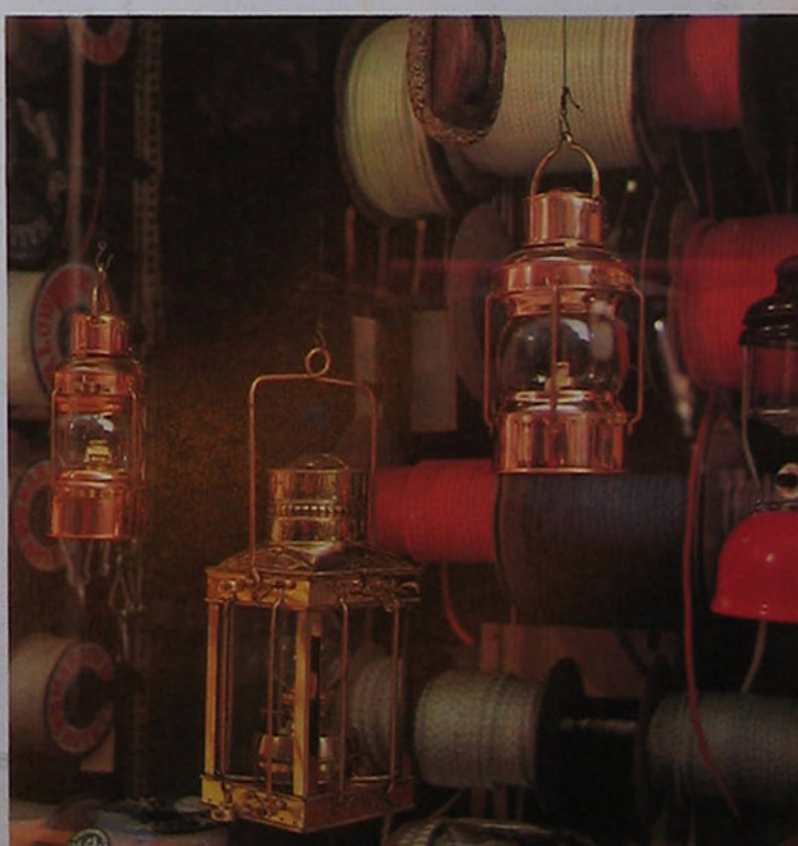
Light which falls on rough parts of the subject becomes depolarized, and passes straight through the polarizing filter on the lens, but light reflected from shiny surfaces retains its polarization, and is stopped by the filter on the lens.

Polarized darkground is a method used for close-up pictures through bellows or microscopes, with subjects which rotate or change the orientation of polarized light passing through them (such as crystals and plastics of many kinds). One polarizer is placed between the light source and the illuminated subject, and another between the subject and the camera. Correctly aligned, the subject shows up in bright colours on a bright background. With a colour polarizer in place in place of the filter below the subject, you can produce a coloured background.

For unusual and striking results, you can try placing a sheet of flat polarizing material over a lamp. Aiming the camera, fitted with a polarizing filter, vertically down, place any piece of cellophane or clear plastic, such as a cigarette wrapper, on the flat polarizing sheet. By rotating the filter on the lens, you can achieve a wide range of coloured effects.

With certain types of plastic, the coloured patterns are changed when the material is under stress. By holding a piece of clear acrylic sheet in front of the lens, and gently flexing it, the changes are clearly visible. This method is used for industrial stress testing.

Shop window *If the camera is pointed directly at a reflective surface, reflections are inevitable, even with a polarizer. By carefully choosing your viewpoint, however, you can eliminate reflections almost entirely*



John Crane

Pushing slide film

If you already do your own slide processing, you can increase the speed of colour slide film, for shots taken in low light conditions, simply by extending development

Tapdance

Snooker champion *Indoor sports of all kinds, some more active than this perhaps, frequently mean shooting under low lighting and extra speed is always useful*

Colour slide film used to need bright light for good results but modern films designed to be exposed at 400 or even 640 ASA (ISO) that give bright, colourful slides are widely available. However, there are times when you need even more speed from your colour film. If you expose your film at a higher than normal speed rating, you must compensate afterwards by extending development or 'pushing'.

The effects of push processing colour slide film are similar to those produced by pushing black and white (see pages 1056 to 1059), but there are marked differences in the details of processing and only the first of the two developing stages is increased.

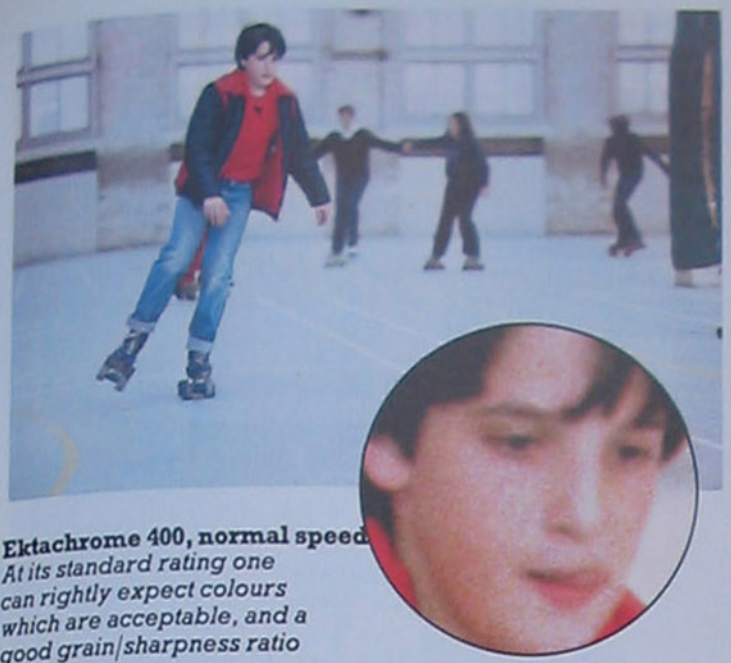
It is worth noting that it is also possible to push process colour negative film. This is not often done, however, since the results are usually not as good as those obtained from pushing colour slide film. Colour balance may shift unpredictably in ways that are impossible to remedy during printing.

Pushing slide film

When you take a picture on slide film, you are simultaneously exposing three separate layers of emulsion, each sensitive to a different colour of light. Each layer contains silver halide crystals, just like other films. And, just like other films, the final image that is produced depends on how fully these exposed silver halide crystals are developed.

With colour slide films, there are two development stages: the first developer, which turns the exposed silver halides into metallic silver; and the colour developer, which forms the dyes that make up the final image. It is the length of the first development that is increased when colour slide film is push processed. The silver halides that are *not* developed in the first developer are translated into a dye image in the colour developer. When the first development time is extended, more exposed halides are developed, leaving less to form the basis of the dye image, and hence giving a less dense final slide.

There are two points that should be noted. Firstly, when you push slide film you reduce the amount of dye available to form the final image. This means that extreme pushing tends to reduce the maximum black of the final image, giving washed-out shadows and dark tones. Secondly, manufacturers design their films so that, at standard development times, each layer of the film is properly developed to give natural colours and contrast in the final slide. When you use a development time other than normal, the layers of the film may not all develop at the same rate. This can lead in extreme cases to very peculiar mixed colour casts. Shadows may look blue while highlights look yellow. It is because of effects like these that it is difficult to push colour negative



Ektachrome 400, normal speed
At its standard rating one can rightly expect colours which are acceptable, and a good grain/sharpness ratio

Ektachrome 400 at 800 ASA
Uprated one stop, there is little apparent change in colour or grain size

Ektachrome 400 at 1600 ASA
Uprated two stops, the film begins to fall apart at the seams. The image is still usable, though

Jack Burnicle

Ektachrome 400 at 3200 ASA
Uprated three stops, the film is usable only when no alternative exists. The image is flat and grainy

Push processing: recommended developing times

Exposure	Development	First developer time
Normal	Normal	6 mins
1 stop under	+30%	about 8 mins
2 stops under	+80%	about 11 mins
3 stops under	+130%	about 14 mins
4 stops under	+190%	about 17½ mins
5 stops under	+225-250%	over 20 mins

This table gives an approximate guide to processing times for pushing Ektachrome films in E6 processing chemicals. Exact first development times may vary according to your processing and exposing technique; use these figures as a starting point for experiment.

film. Fortunately, the problem is not so severe with colour slide film, but it may still be encountered if you push your film too far.

Moreover, the distorted colour that sometimes results from pushing can occasionally be used to enhance the look of your pictures. Apart from being a useful technique in low light, or to rescue accidentally underexposed film, pushing can give a number of interesting special visual effects.

Process steps

When development is extended it can be difficult to give a precise relationship between the increase in film speed and the degree of development used. This is because increasing the speed by extending development also tends to increase the contrast of the picture, but only up to a point. The precise amount of development required for a given film speed increase must be found by the user, particularly since different films show different characteristics when pushed. The accompanying table gives a rough guide to results with Kodak's E6 process, but results may vary according to the film you use.

The way most professional photographers find the effects of pushing a film is by making a 'clip' test. You can do this in your own darkroom. In total darkness, cut about six frames (22 cm) from the beginning of your 35 mm slide film—unfortunately you are bound to cut through one frame, so bracket exposures to avoid losing an irreplaceable shot.

Load the short clip of film into your developing tank. Estimate the adjustment you need to make to the first development time by referring to the table and carry out a trial process run. When these few frames are completely processed and dried, assess the results. You can then either process the rest of the film in the same manner or make a further adjustment to the first development time to get the result you want. Whatever you do, remember to make careful notes so that you have a permanent

Uprated Ektachrome compared

Ektachrome 200 at 400 ASA
Pushed one stop, this film offers clean whites, good colours and fine grain

Jack Burnicle

Ektachrome 400, normal
In comparison, this film has a more contrasty image and cooler colours

Ektachrome 200 at 800 ASA
Pushed two stops increases grain size substantially but the image is acceptable

Ektachrome 400 at 800 ASA
In comparison, colours are more vibrant but grain also much larger

Ektachrome 200 at 1600 ASA
Pushed three stops, beyond its acceptable limit, grain is large and colours muted

Ektachrome 400 at 1600 ASA
Colours are better, but the image starts to fail. Grain size is very large

record of the effects produced by different degrees of exposure and development.

Apart from the altered first development time, push processing slide film is exactly the same as normal processing. Follow the usual precautions with chemicals and temperature control, and avoid touching the delicate film emulsion until it is completely dry.

Judging results

When most Ektachrome film is push processed to allow for one stop less exposure, the most obvious effect is that the colour balance shifts slightly to yellow–red. This is not necessarily a bad thing since many Ektachrome films give results that look slightly bluish when normally processed. There is also a slight increase in contrast which can give slightly cleaner highlight areas. Usually there is no degradation of the shadows. The results obtained do not look very different from a normally developed image, but the slight increase in contrast can be useful in those cases where just a little more 'punch' is required in a picture.

When the film is pushed to give two stops increase in speed, the visual differences start to become more apparent. The fog level of the film starts to increase because of the extended development (see page 1058). There is less dye in the emulsion, and shadow areas show a loss of detail and contrast.

Another side effect of lengthened first development is that the size of the grains of silver in the film is increased. This leads to the formation of larger dye clumps in the finished slide, giving an appearance of graininess and reduced sharpness. The lowered sharpness and reduced saturation of the colours can give the image an appearance of softness, although in fact the ability of the film to cope with contrasty subjects is reduced.

When the film is pushed four stops or more, all these visual differences become much more pronounced. With this degree of pushing the image begins to become quite interesting in its own right. The shadows are smoky-looking and lack detail, the highlights are very washed out, graininess is very noticeable and there may be a strong colour shift.

The reduced contrast range of severely pushed slide film makes it essential that you expose your film properly. Slide films generally do not have much exposure latitude, and pushing reduces your margin for error even further. You must make your meter readings very carefully. With normally processed slide films it is often good practice to tend towards slight underexposure—the simplest method is to add 50 per cent to the film rate on the camera's film speed setting. In this way you can be sure that the highlights are not too pale and washed out. With pushed film, however, you can expect subject highlights to be washed out, so you can base your exposure more on the important middle tones of the subject. To be on the safe side, bracket your exposures carefully.

Steve Ballantyne/picture courtesy of 25th Street

Streets ahead *Push processing enables you to take pictures under extremely suspect lighting conditions. Although it may be possible to meter in a situation such as this, coloured lighting (which forms a cast that disguises any push processing cast) often calls for a great deal more speed*

Pushing for effect

Providing you process your film yourself, the technique of pushing colour slide film is no more difficult than normal processing. However, if you do not do your own colour processing, you can have your films pushed by a processing laboratory. Many laboratories will push films and carry out clip tests. The technique can be used to correct for accidental underexposure, but you may prefer to underexpose and push process your films deliberately in order to exploit the visual effects that are produced. These effects usually work best if the film is given a considerable push—four stops or even more. At extreme levels of pushing there is very little silver halide left in the film available for colour development, so colours are very muted and the density range is extremely compressed.

Instead of taking pictures especially for push processing, you may prefer to copy one of your existing slides and give it a different look by pushing the copy film. Use standard slide duplicating techniques (see page 726 to 729) to copy the slide you have chosen, underexposing the film according to the degree you intend to push. Normally, when you make a copy, you should use special duplicating film, but, when you are copying for pushing, the lower quality caused by using an ordinary film does not matter. In some cases it can be an advantage—for example, a normal film gives slightly higher contrast than a duplicating film, and this combined with the compression of tonal range given by pushing can give an interesting graphic effect, particularly if you are copying a slide with strong subject contrast. The result can be a sort of colour equivalent to a lith or line effect. If a low contrast original is used, the effect of soft outlines and muted colours can be enhanced by using a diffusing filter. Colour filters can be added to give an overall colour cast, or partially counter a cast caused by pushing.

All the techniques involved in pushing give you scope to create interesting new images. When you have mastered and understood the basic process, use this as a starting point and experiment with various films to obtain the kind of results that you require.

Creative approach

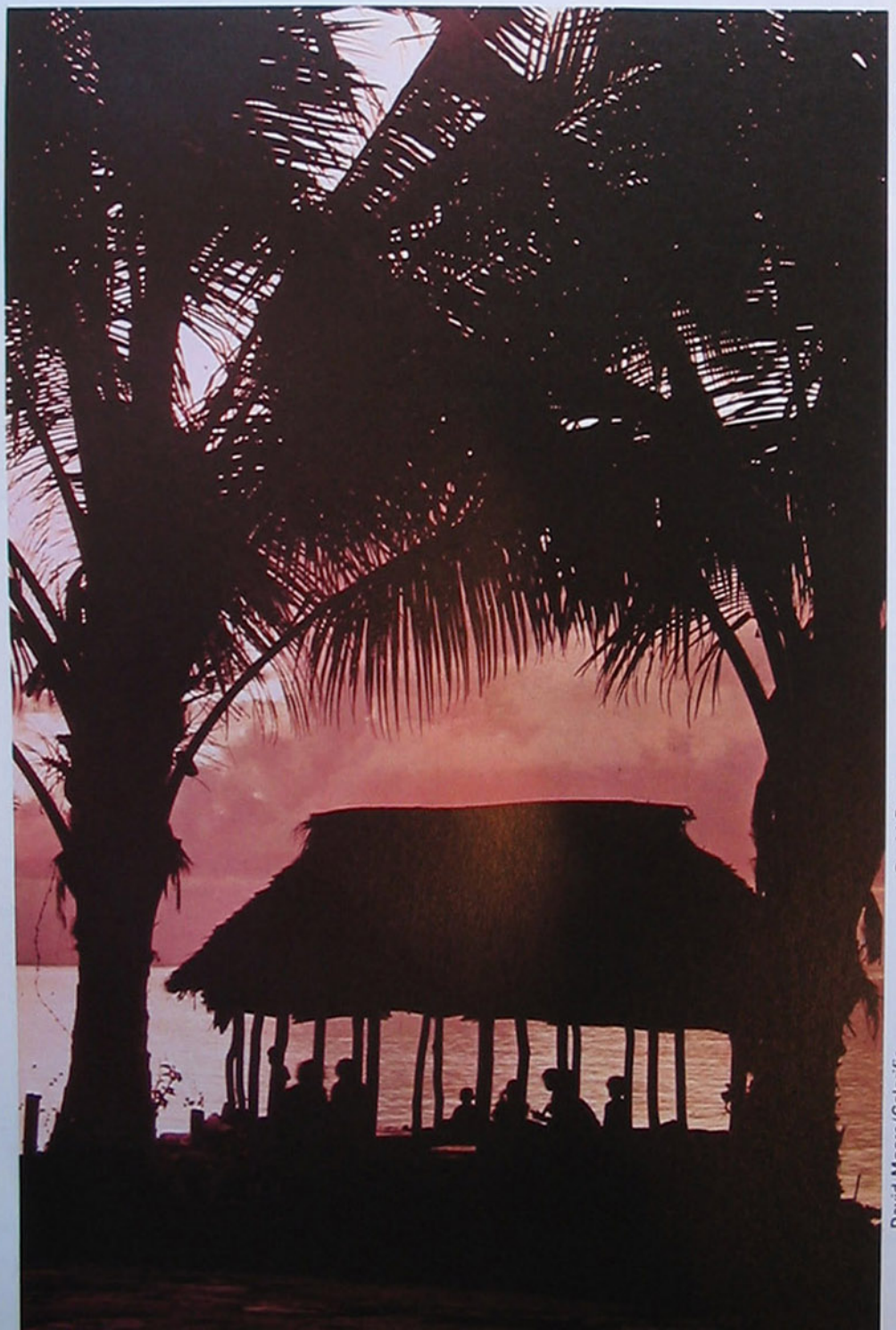
Silhouettes

Reducing objects to dark outlines, silhouettes can make strong simple images from even the most mundane subjects wherever you can find a light background

Early in the 18th century, a French government minister named Etienne de Silhouette began to make simple outline portraits by cutting out profiles from black paper with a pair of scissors. Soon other people began to copy the idea and for a while, making silhouettes was a very fashionable pastime.

The attraction of silhouettes lay partly in the extreme simplicity of the idea, and also in the possibilities they offered for suggestion—they were able to convey the personality of the subject with no more than an outline. Although the popularity of silhouette portraits has long since waned, the term has acquired a much more general usage and the silhouette can be a very effective photographic device.

Photography is particularly well suited to making silhouetted images, and provided that you choose the right materials and can manipulate the lighting correctly, there will be no technical problems. Shapes become silhouettes when the contrast is extremely high, and high contrast is something that the photographic process produces well.



David Moore/Colorific

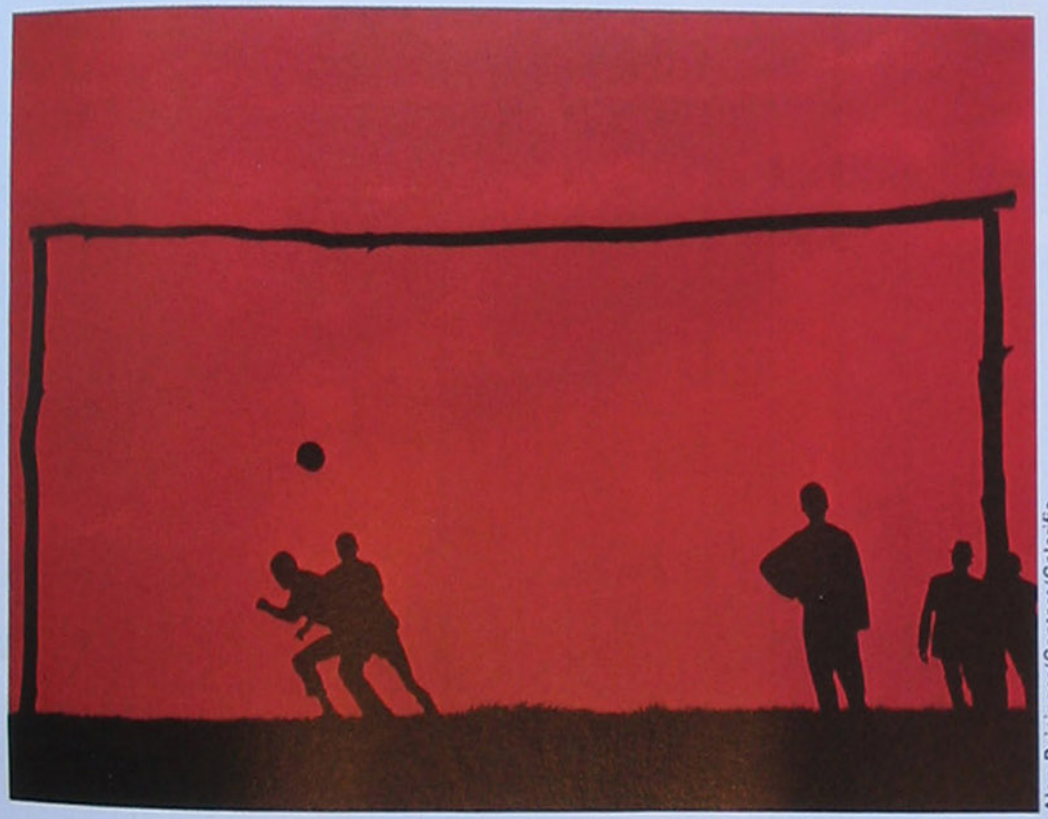
Green pattern *Silhouettes need not be outlines—here an effective abstract has been made by shooting through a leaf hole and exposing for the background*

Tropical paradise *The simplicity of a silhouette can make a very restful image, reminiscent of the unruffled calm of a tropical evening*

Dark lantern *A pure blue sky makes a bright, clean background for simple, graphic silhouetted images—expose for the sky so the subject is rendered darkly*

G. I. Bernard/Oxford Scientific Films

David Daye



Alon Reininger/Contact/Colorific

Red goal *An alternative way of making silhouettes against the sky is to shoot through a deep red filter such as a Wratten 25R*

As an image, a silhouette is interesting because it uses very little to suggest a great deal. Effectively, it is made up of two contrasting tones and a sharp edge, but from this, a viewer can infer much more, such as perspective, depth, and details hidden in the darkness of the outline. As with all photographs, you can make the image more interesting and memorable by deliberately witholding information—that is, showing only a part of what you want the viewer to see, and leaving the rest to his or her imagination. The power of suggestion can be very effective and silhouettes can make simple and attractive pictures from even the most mundane subjects.

One of the attractions of silhouettes is that they can conceal unwanted detail and turn a rather fussy subject into a clear, strong image. A picture of a tree in full leaf, for instance, can often turn out less successfully than you imagine because the abundance of detail confuses the eye. But in silhouette, with all the distracting detail hidden in shadow, the outline of the tree can make a much more attractive photograph.

However, because detail is often lost in silhouettes, you must take much more care in the presentation of the outline. It is often important that the subject is easily recognizable from its silhouette, for instance. With some subjects, such as birds in flight or people, this is rarely a problem. With others, particularly where a number of different objects overlap, identification can be much harder. It is important, therefore, to concentrate on subjects with very distinctive outlines unless you are using the silhouette simply as part of a graphic design.

It is also important to isolate each silhouetted object so that there is no confusion of outlines—if you can, try to include the outline of the whole object. For instance, when you want to photograph silhouettes against a setting sun, it is usually best to avoid cutting off the bottom of the subject by allowing a dark horizon to occur behind the silhouette. Always make sure that the subject is on high ground or that you get down close to the ground and shoot upwards. This way the complete subject can be outlined against the sky.

Even with clearly recognizable subjects, it is worth moving round and experimenting with various viewpoints until you find the strongest outline. Many subjects give a distinctive silhouette only from a particular angle. A horse, for instance, clearly presents a much better silhouette from the side—from behind or in front, their shape is rather weak. Only exceptionally, therefore, will a head-on silhouette of a horse make a good picture. With people, of course, the best 'profile' is obvious—though it may be worth experimenting with alternatives for unusual effects.

For other subjects, the best profile may be less obvious—often it needs only small movement to make all the difference. With a moving subject, it is well worth waiting or bracketing exposures until you find the best profile. Wait until the animal raises its head, or the bird swings round to present its wings clearly against the sky, before shooting.

When shooting silhouettes, remember that as you take the photograph, you see the subject in context; the viewer will not. So it is important to choose a viewpoint that conveys all the necessary detail. A frontal silhouette, for instance might conceal the rod of the fisherman while a side view shows it up clearly.

However, clear identification of the scene is not always important. Indeed, silhouettes can often give a completely new look to the subject. Sometimes this is a result of the exposure techniques needed to achieve a silhouette. If you underexpose on a bright day to achieve a silhouette, the sky may be recorded in such a dark blue that the scene appears to be moonlit. By taking a completely objective view of your subject,

Graeme Harris

Couple walking *When shooting against the light, shadows may intrude. Watch for them and use them in the composition*

Plantpot *Doorways and windows make effective frames for delicate silhouettes with indoor shots*

Webbed roof *Silhouettes need not always be instantly recognisable—they can be used to create a simple graphic design*

John de Visser

Anne Conway

Vautier de Nanxe

you can use a silhouette image as a purely graphic device, experimenting in the composition with proportions, lines, and the relationship between the shape of the subject and the picture frame to create an abstract picture.

Silhouettes also have a useful place in special effects photography. A backlit horizon line cut out from card or similar material can make a simple and convincing backdrop to a shot constructed in the studio. Or, for instance, where reflections are prominent in a still-life shot—such as with glass, polished metal or drops of liquid—a cut-out silhouette can be taped on to the front of the light source itself. There are too many special uses to categorize, but all take advantage of the silhouette's main attribute—simplicity.

Nevertheless, a succession of silhouettes can become as tired and uninteresting as any photographic device, and it is important to achieve as much variety as possible in silhouetted images. Look not only at the different technical ways of producing them, but try exploring all the possible creative effects.

Striking *When taking silhouettes of action subjects, look for the clearest outline and wait for the movement to reach its peak*

Industrial sunset *In outline, even the grimmest industrial scene can take on an air of mystery and romance, enhanced by a large, smoky sun*

Stouffer Enterprises Inc./Earth Scenes/Oxford Scientific Films

Michael Freeman

Falconer *Plain, brightly lit white paper is an effective backdrop for studio silhouettes of subjects with such a distinctive profile as this falconer*

Constructive image *With interesting arrangements of figures and horizontal and vertical lines, scaffolding erection can be a good subject for silhouettes*

There are three principle ways of making silhouettes—by exploiting natural tonal contrast, by backlighting the subject and by heightening contrast in the darkroom.

Natural tonal contrast between the subject and the background—in other words, irrespective of the lighting, a dark subject and a light background—is the simplest method. Anything from light grey concrete to a brilliant white sail can provide a background for a silhouette—the main essential is that the contrast between background and subject is exceptionally high, but you need a high contrast film such as Kodachrome 25 to exploit it to the full.

Most scenes, however, do not have such a high contrast themselves, and for a strong silhouette, the second method, backlighting, usually has to be adopted. In an ordinary room, you can black out all the windows except one, and use that, perhaps, for the silhouette of a face. If the window faces out on to a clear sky, so much the better, but if not, tape a large sheet of tracing paper over the panes.

Backlighting does not just mean that the sun or a studio lamp is directly behind the subject—there are many other variations. The essential ingredients are that little light falls on the subject and that the background is as bright as possible. The strongest form of backlighting is when the light source itself is large enough to form the background. In a studio, this is possible with a relatively small subject and an area light.

It is normally easier to use reflected light, however. In a studio, a white backdrop is ideal—a white paper roll in the case of a portrait, or the more reflective type of plastic for a smaller still life subject. Aim the lights at the backdrop from just in front. For completely even lighting, use four lamps, each aimed from just beyond one corner of the picture area. The main precaution is to shade the sides of the lamps so that no light spills on to the subject in front, and keep the rest of the studio dark.

Outdoors, there is a greater variety of reflected backlighting, but it is not always predictable. On a slightly hazy day, the sky close to the sun reflects its light strongly. In unsettled weather, heavy white clouds can also give a good setting for silhouettes, particularly if the subject itself is in shadow. Bright solid surfaces, such as painted walls or smooth areas of rock, also make it possible to exploit the differences between light and shade. One way of accentuating the contrast is to shoot from indoors out through a door or a window.

Vautier/de Nanxe

White is by no means the only choice for a backdrop, and one useful way of bringing variety to silhouettes is to choose a coloured background. This might be a painted, man-made surface, but a blue sky, or the reds and oranges of a sunset or sunrise, can also be very striking. Twilight, even though the light is dim and usually calls for a tripod, is often excellent for silhouettes because, if there are few clouds, the light comes from a broad and gently graduated area of sky. For horizon photographs, of mountain landscapes, for instance, twilight usually gives the best silhouettes.

One of the most interesting surfaces for reflected backlighting, at the right time of day, is water. In mid-morning and mid-afternoon, when the sun is not too high, a lake, river or the sea can give a shimmering, sparkling and intense reflection (the actual angle that gives the best results depends on how high you are above the water). If there are small waves, so much the better, for they broaden the area of reflection and also give some texture to the silhouette's background. To take full advantage of this kind of situation, you will probably find a telephoto lens the most useful—it allows you to select a bright area of water to fill the picture frame.

Another way of producing silhouettes is to print or duplicate the negative or transparency on to high contrast material in the darkroom.

For the strongest silhouettes of all, use line film. This, with the appropriate developer, gives negatives or positives with no tonal gradation whatsoever—simply black against clear film. It is available mainly in sheets, and it is used by making a simple contact print from an original on normal film in the darkroom (see page 914 to 917). Retouching, which is usually necessary to clear up the background around a silhouette or fill in details on the subject, is simple and calls for little artistic flair—pen and ink or a small brush with process or opaque work perfectly.

Whatever method you use to produce a silhouette, though, ask yourself whether it really works. It is all too easy to produce a picture that at first seems really good, but palls on second viewing. Either the outline of the subject must be interesting, or the background attractive, or it must form part of a striking composition.

Colin Molyneux

Distant tree *With a minimum of distracting detail, silhouettes provide strong, simple images ideal for slightly unusual, almost abstract compositions*

Richard & Sally Greenhill

Skateboarders *In strong sunlight, contrast is high and silhouettes can easily be made by shooting subjects in shadow against white, sunlit backgrounds—but beware of 'cutting off' feet!*

Graeme Harris

Grass *For silhouettes during the day, find a low viewpoint and shoot upwards towards the sun. Expose for the sun to render your subject darkly against the sky*

Understanding...

Light through the lens

The amount of light reaching the film is a crucial element in exposure but, even with the best lenses, some light is lost on the way through the lens and it is important to know just how much

For correct exposure, it is vital to know exactly how much light is coming through the lens. While TTL meters can measure the light directly it is useful to know just what controls the amount of light transmitted through the lens.

The main limitation on light transmission is the aperture of the lens (see pages 46-7). Indeed, on the vast majority of camera lenses the aperture can be varied to control light intensity. The amount of light actually reaching the film is also affected by the distance it has to travel from the lens. So the system used to represent the aperture—*f*-numbers—is related to the focal length of the lens. In fact, the *f* stands for focal length, and this is divided to give the aperture size. So for a 100 mm lens, *f*/4 means an aperture of 25 mm.

The *f*-number for each size of aperture is calculated for a lens set at infinity. When the lens is moved away from the film, to focus on closer objects, the light has to travel further. The consequent spreading of the light according to the inverse square law (see page 254) means that less light reaches the film. This decrease in light intensity can be calculated. Tables are available for close-up work, where the effect is most noticeable, to show how much extra exposure is needed to compensate. But even when all the theoretical calculations have been made, the result may still not give a precise indication of the light transmitted by the lens for a number of reasons.

Light losses

The glass used for photographic lenses is highly polished and so is highly reflective. This means that some of the light falling on a lens element is reflected by it. This becomes apparent when you look at the front element of a lens. Clear reflections of light and windows can be seen, an effect repeated at each glass surface.

John Heseltine

Fall off *Vignetting causes light loss at the corners*

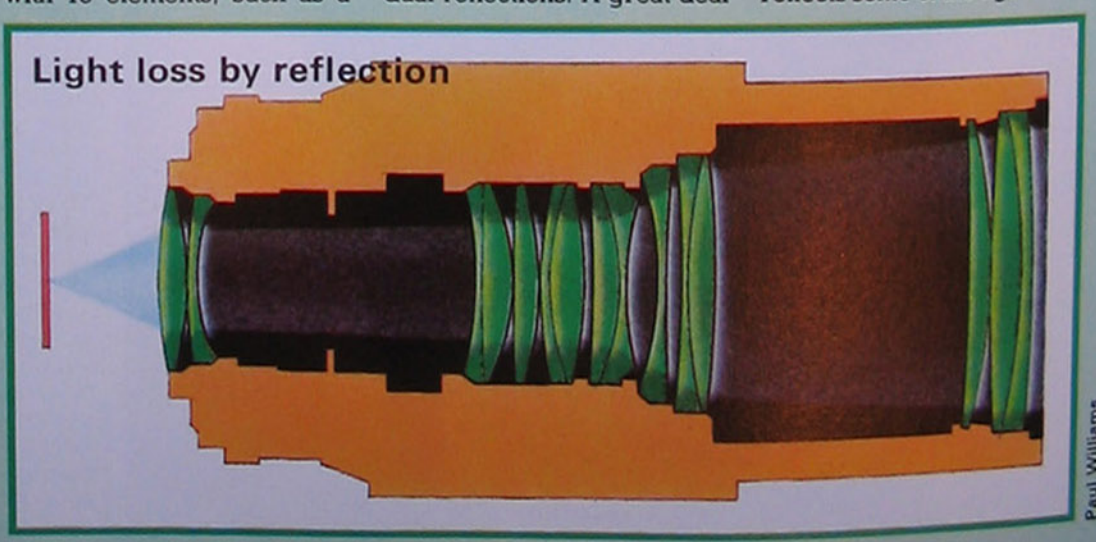
For an uncoated surface, reflection losses are four per cent of the arriving—incident—light, increasing with the refractive index of the glass. When the light passes through the next surface, four per cent of the light transmitted by the first surface is lost. A four-element lens has eight surfaces, and the resulting light loss may be over 25 per cent. An uncoated lens with 15 elements, such as a zoom, transmits only 30 per cent of the incident light.

Fortunately, a single anti-reflection coating on a lens surface increases transmission to about 98 per cent, and multi-layer coatings to better than 99 per cent. In the case of the 15 element zoom, this increases transmission from 30 to 74 per cent.

But even with the aid of coatings, there are still some transmission losses, partly due to absorption of light by the glass, and partly to residual reflections. A great deal depends on the precise construction of the lens. As the number of elements affects the reflections, so the thicknesses of the elements affect the degree of absorption.

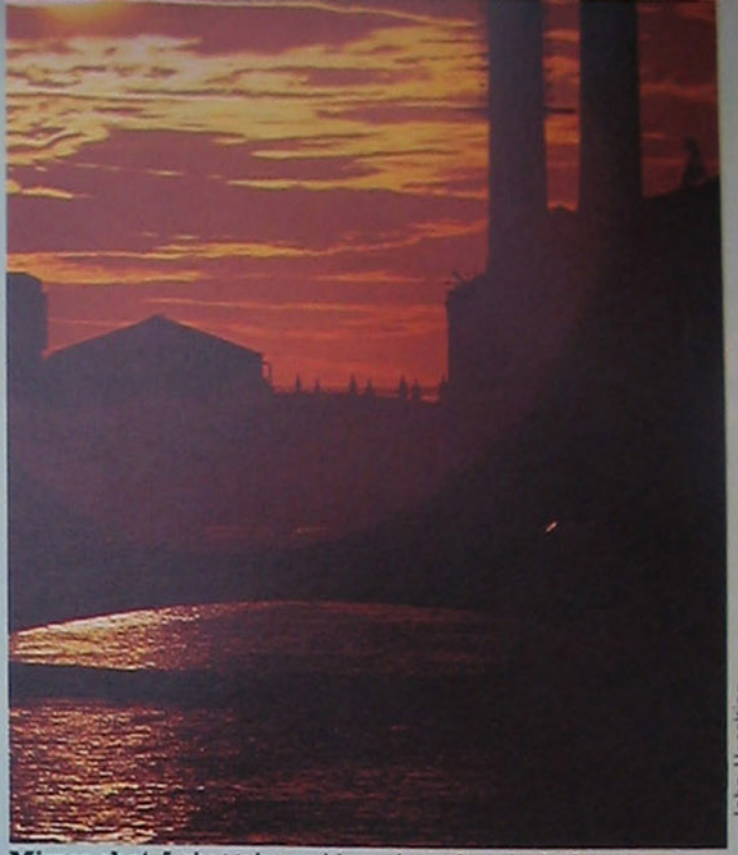
A side effect is that different types of glass absorb differently over the spectrum. This *differential absorption* causes slight differences in colour balance or rendition from lens to lens. Some lenses

Complex lens *Light loss can occur as each element reflects some of the light*



Paul Williams

Sunset *Unlike a mirror lens, a conventional lens does not have a central obstruction, and gives this result at f/5.6*



Mirror shot *A shot taken with a mirror lens is darker, even though it has a nominal aperture of f/5.6*

John Heseltine

may seem to be marginally 'warmer' or 'colder' than others. Manufacturers often take care to make a series of lenses consistent in terms of colour, so that photographers can change lenses without worrying about the colour changing. This is achieved by variations in lens coatings.

Dark corners

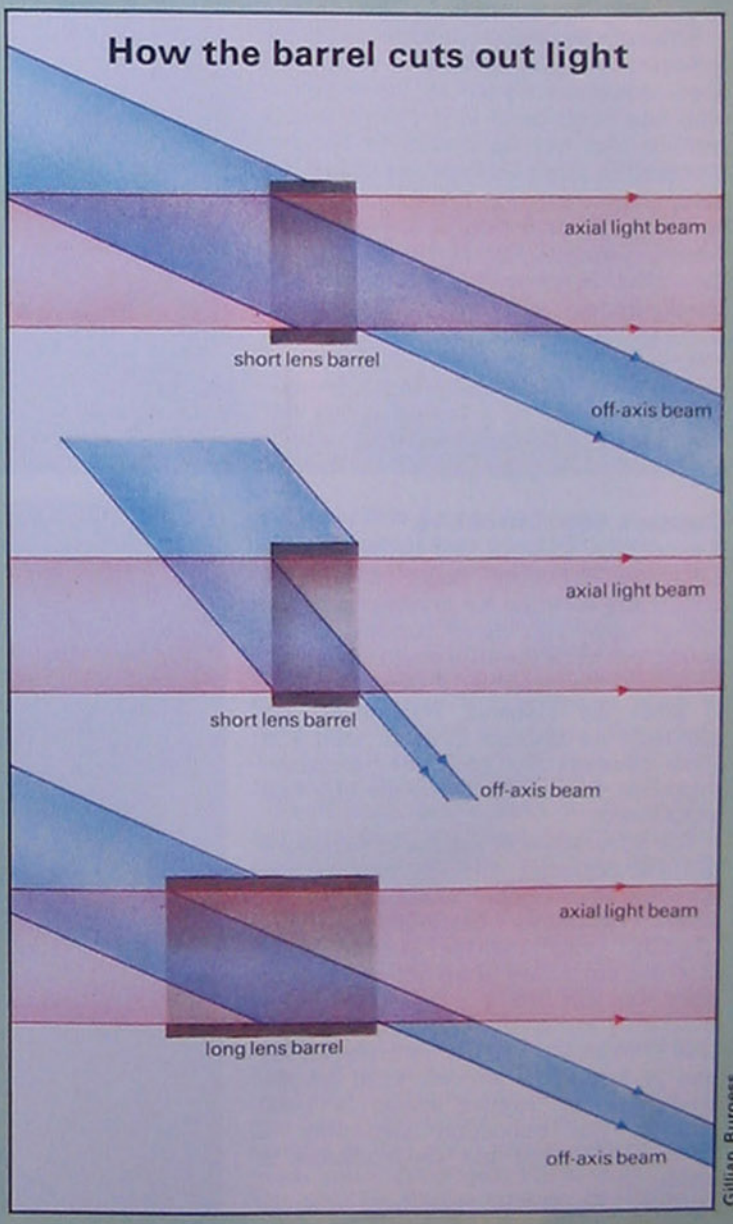
A more selective type of light loss is *vignetting*. This is characterized by darkening of the corners of the image, and is worse at large apertures. Vignetting occurs simply because, like any long tube, the barrel of the lens cuts out some light. A beam of light travelling parallel to the axis of the lens is unaffected. But light at an angle to the axis may strike the sides of the barrel and is lost to the picture. Wide angle lenses, because of their wide view—so that light from a very steep angle is included in the view—are more prone to vignetting than longer lenses. However, wide aperture lenses which emphasize the difference between the central beam and the off-axis beams, also suffer.

The result of all these losses is that the light actually transmitted by the lens does not correspond exactly with the marked aperture. The *f*-numbers are calculated by geometrical methods and take no account of these losses. For example, two different lenses, such as a 12 element wide angle and a five element telephoto, both set at the same *f*-stop, will actually transmit different amounts of light.

Solving the problem

Through-the-lens metering allows for light losses. But when separate meters are being used, and especially in critical applications such as cinematography and television work, the lens aperture may be determined *photometrically*, that is, by actual measurement of the light transmitted. In this case, the *f*-stop scale is replaced by a *T*-stop scale (T stands for transmission). An aperture which would be given a geometric value of, say, *f*/2, may be reduced in extreme cases to *T*/2.8.

A good example of the difference between *T*-stops and *f*-stops is the case of mirror lenses. The *f*-stops given with such lenses are calculated geometrically using the diameter of the main mirror. But, due to the obstruction caused by the secondary mirror set in to the front, the *T*-stop may be as much as one stop slower. A hand-held meter can therefor give an incorrect reading.



Vignetting *The barrel of the lens cuts out some of the light arriving at an angle*

Gillian Burgess

Point and shoot cameras

Point and shoot SLR cameras combine versatility with compactness and simple operation. They are ideal for the beginner or as a second camera for the 'serious' amateur and are among the cheapest of SLRs

Though it takes only a few seconds to adjust the exposure on a manual SLR with through-the-lens metering, those few seconds can be vital. When photographing live subjects, a particular pose, expression or composition may only be fleeting, and the less time wasted between seeing the shot and taking it, the more chance of success you have.

Point and shoot cameras, like all automatics, are designed to make life easier for the photographer. The lens aperture or shutter speed is set for you by the camera, leaving you free to concentrate on the things that really matter—lighting and composition. However, whereas most automatics also allow for manual control over the automated exposure, genuine point and shoots have no such manual option—you cannot override the metering to allow for backlit subjects, for example.

Although this may sound limiting to the experienced photographer, point and shoot cameras are ideal for the beginner who has been used to a 110 or instant camera and has no desire to become involved in stops and speeds at such an early stage. And even if you already own an automatic or a manual SLR made by Canon, Olympus, Pentax, Nikon or any of the other manufacturers of point and shoot cameras, you may find a point and shoot an ideal second camera. If you can afford to buy more than one SLR, it would be worth considering a sophisticated manual or automatic SLR for yourself and a point and shoot for certain situations or for your family.

Richard & Sally Greenhill

Snap shots, *like this one, are easy with a point and shoot. Here a narrow aperture has been set and the camera has automatically selected a slow shutter speed, blurring the background*

Camera sophistication

It was once thought that cameras with automatic exposure could never be sufficiently accurate for professional use. But as more and more photographers began to realize the advantages of such a system so the technology was improved to meet the demand. Nowadays, the automatic mechanism in most point and shoot cameras can give very accurate exposure without the need for any fine adjustment.

The advantages of automatic exposure can be obtained through one of the cheaper and lighter automatic direct vision viewfinder cameras, like the Olympus Trip. However, such cameras lack the versatility of an automatic SLR. They are not really suitable for portraiture or for sports work because the lens is fixed and cannot be changed for one of longer or shorter focal length, while the top shutter speed is 1/200 second. For maximum versatility, a 35 mm SLR point and shoot camera is essential.

Many beginners require cameras which allow them to do nothing but aim and shoot, with all other functions being taken care of automatically. But no SLR is this simple—at the very least, the user must set the film speed. Usually the aperture must be set as well.

Most point and shoot cameras have *aperture priority*—you can set the *f*/stop but you have no control over the shutter speed, which is set automatically by the camera (see pages 200-202)—although

Dave King/equipment courtesy of Canon

Programmed operation *When the Canon AE-1 Program is set at 'program', both shutter speed and aperture are selected automatically by a tiny computer inside the camera body*

Dave King/equipment courtesy of Canon

Canon A-1 *Though not a point and shoot camera, the A-1 has the same program facility as the AE-1 Program*

a few, like the Canon AE-1, use *shutter priority* systems. In addition, there are two other automatic systems—the *programmed* system in which both shutter speed and lens aperture are set, and the *multi mode* system. Multi mode cameras are, however, not genuine point and shoot cameras since they give you a choice between manual, aperture priority, shutter priority or programmed systems.

One of the major advantages of point and shoot cameras over other automatics is that they offer a reasonable degree of sophistication at a very low price. Most of the point and shoot cameras currently available fall within the budget price range. They are not only cheap, but also

Richard & Sally Greenhill

Simplicity itself *The controls on the Pentax MV 1 could not be simpler. The 100X setting is for flash*

Dave King/equipment courtesy of Pentax

Roller action *A point and shoot lets you concentrate on composition and leave exposure to the camera*

compact and light, and handy as a general-purpose camera for carrying around.

Point and shoot cameras can usually be fitted with most of the system accessories designed for use on the more expensive models produced by the same manufacturers. Pentax, Canon, Nikon and Olympus all make point and shoot cameras which can be used in conjunction with a whole range of lenses, autowinds and electronic flash units. Technological developments applied to more expensive cameras are frequently handed down to the cheaper models. For example the off-the-film metering system designed for the OM-2 has been applied in a modified form to the cheaper OM-10 point and shoot.

Point and shoot cameras can be limiting, however. If you have bought one of these cameras but find that your photography has developed to the point where manual metering, interchangeable viewing screens and finders, or motor drives are required, then a more sophisticated camera is necessary. Your point and shoot, though, will still serve as a handy reserve body.

Point and shoots tend to be cheap because they are mass produced with materials less durable than those used on more conventional SLRs. Instead of brass top plates, they may use plastic, for example. However, this material is perfectly suitable for most purposes and should withstand normal use. For the professional, whose camera is expected to function reliably under all conditions, they are less suitable.

Another point worth remembering if you are considering buying your first camera is that point and shoots will not teach you a great deal about technique. You may be able to take good pictures,

but the niceties of shutter speeds, apertures and depth of field can remain a mystery. The manufacturers sometimes deliberately leave such potentially confusing details as shutter speeds off the camera, and only give an indication by means of an LED when a tripod is needed, as a slow speed has been selected. The Pentax MV-1 is an example of this type of camera.

Many photographers question the advisability of using an automatic as a first camera. You could use the camera for years without ever understanding how you might improve your pictures by by taking the trouble to select the depth of field, for example. A purely manual SLR, however, is often cheaper and also requires that you think before you shoot. In this way you will soon learn how the technical details affect the pictures.

Aperture priority cameras

Compared with the vast number of normal automatics and manual SLRs currently on the market, the range of point and shoots is limited. Essentially, there is little difference between them; your choice must depend upon your initial reason for buying a point and shoot and upon the direction that you see your photography taking in the future.

If you are buying a point and shoot as a second camera then your choice must be governed by the type of first camera you have. If possible, you should buy a point and shoot camera which has the same type of lens mount as the camera you already own.

Dave King/equipment courtesy of Canon

Dave King/equipment courtesy of Olympus

Dedicated flash *units can be fitted to most cameras and these synchronize the shutter automatically*
Lightweight *Most points and shoots are compact and light—the OM-10 body weighs only 450 g*

If, on the other hand, your point and shoot is your first camera you should consider carefully how you think your photographic needs may develop. If you feel that you are never likely to progress beyond fairly simple snapshooting requiring few sophisticated attachments and features, then virtually any model will do. If, on the other hand, you feel that you may later wish to move on to more complex photographic work, then your choice must be thought about carefully. The Canon AV-1, Nikon EM, and MG Pentax MV-1 and Olympus OM-10 can be used in conjunction with some of the range of system accessories produced by the same manufacturers. So, if, at a later date, you decide to buy a more sophisticated Canon A-1, Nikon F3, Olympus OM-2 or Pentax LX, you can use the same lenses and other accessories purchased for your point and shoot. The same thing applies to the Cosina CT3, which uses the versatile Pentax K mount, and the Yashica FR2 which has the same mount as the more sophisticated Contax cameras.

Furthermore, there are varying degrees of sophistication among the

Dave King/equipment courtesy of Olympus

Manual override *Although a genuine point and shoot, the OM-10 can be fitted with a manual shutter control*

ranks of point and shoot cameras. The Pentax MV-1, for example, gives no shutter speed readout, while the Mamiya ZE has contacts on the lens bayonet which indicate to the camera which lens is in use. An optional attachment for the Olympus OM-10 allows full manual override, making it much more versatile.

Aperture priority is a cheaper system to produce than *shutter priority* because fewer mechanical linkages are required between the lens and the camera. Most aperture priority cameras also have electronic shutters. Unlike spring operated shutters which have speeds that progress in steps—1/60, 1/125, 1/250 second and so on—most electronic shutters have speeds that vary continuously. They are thus infinitely adjustable. If the stop you have set calls for a shutter speed of, say, 1/210, the camera will automatically set the shutter to exactly this speed, and exposure will be totally accurate.

Aperture priority automation is ideal if your subject calls for control over depth of field. If you want to keep both near and distant objects and the horizon in focus, you can stop the lens right down to obtain maximum depth. The camera will then set the shutter to the optimum slow speed. If on the other hand you want to 'draw' out an object in the foreground and throw the background out of focus, you can select a large stop, the shutter then setting itself to a fast speed.

If you find that having the shutter speed set for you is limiting, for sports or action work, for example, you may wish to consider one of the more expensive programmed or multi mode cameras which offer you a choice of priority.

Programmed and 'multi mode'

On programmed automatic cameras, both the shutter speed and the aperture are set for you, the combinations running from full aperture and a slow speed in poor light conditions to a small stop and a high shutter speed in bright light. In between, they can set a good average stop–speed combination according to the brightness of light and the speed of the film you are using. All you have to do is to focus and press the release.

On the whole, cameras with program mode are more expensive than simple point and shoots. So if cheapness is your sole reason for buying a point and shoot, a programmed model may be unsuitable.

On the other hand, if it is the convenience of point and shoot as an additional feature that you are looking for, you could consider a programmed camera like the Canon AE-1 Program, which offers programmed, manual and point and shoot (with shutter speed priority) modes. An added advantage of the Canon is that it can be fitted with the FD 35-70 mm zoom AF lens (see page 1176) to become completely automatic. Exposure and focusing will then be set whenever you touch the appropriate switches.

The most expensive automatic cameras are multimode. They allow you to choose between manual exposure setting, aperture or shutter priority or programmed. In theory, this should give you the best of all worlds since you can set the type of automation that best suits the subject. In practice, deciding on which system to use sometimes takes more time and thought than simply setting the exposure manually!

Point and shoot cameras suffer from all the drawbacks normally associated with simpler automatic cameras. Exposure can be fooled by backlit subjects or white subjects against a dark background. But as a spare camera or body for an existing system they are ideal.

If you are a beginner who is very keen to learn the techniques of photography or already have an automatic compact, then a point and shoot is probably not for you. However, if you are uncertain as to whether your photography will ever become sufficiently advanced to merit buying an expensive automatic or manual, a cheap and versatile point and shoot SLR is ideal.

Canon family *These three cameras offer a range of automatic operation, from simple to sophisticated*

Dave King/equipment courtesy of Canon

Photographing the Universe

Photography ranks second only to the telescope itself as the most important of the tools of the astronomer. Each technical advance can literally increase the size of the known universe

Which is the biggest camera in the world? The answer is a surprising one—it is mounted on a remote mountain top in the Soviet Union, and it weighs hundreds of tonnes. Its pictures, and those of similar cameras throughout the world, are among the most remarkable ever taken. For it is actually an astronomical telescope.

The world's largest optical telescope, like most big telescopes, is, in effect, a giant camera. The focal length of its optical system is 24,000 mm, though by using what amounts to a sophisticated teleconverter system, the focal length can be boosted to a staggering 180,000 mm. And although the aperture of the system is a full six metres, compared with the 25 mm or so of a standard lens, it is actually not as fast, in photographic terms, as the lenses on most SLRs. Its *f*-number is 4, as against the *f*/2 or faster of even a budget SLR lens.

This comparison between a telescope and a camera may seem strange, but it is a very apt one since much of our present knowledge of the universe is due to the use of photography. Even today, when highly efficient electronic detectors are available, photography is still the most effective way of using a telescope for many purposes.

The photographic emulsion is not actually a very sensitive light detector. The eye is much more efficient, as you can see for yourself when taking any night shot. In a fraction of a second your eye gives you a finely detailed view of, say, a moonlit scene. But take a picture using a slow emulsion so as to reproduce as much detail and you will need an exposure of many seconds to show the same scene.

But the crucial factor in favour of photography is not its sensitivity but its ability to go on storing light. Increase the exposure time in your experiment and you will find it possible to record detail in parts of the scene where your eye saw only deep shadow. What the eye does not see in a fraction of a second it will never see. The photographic emulsion, however, goes on storing up light—and this is what makes it so useful to astronomers.

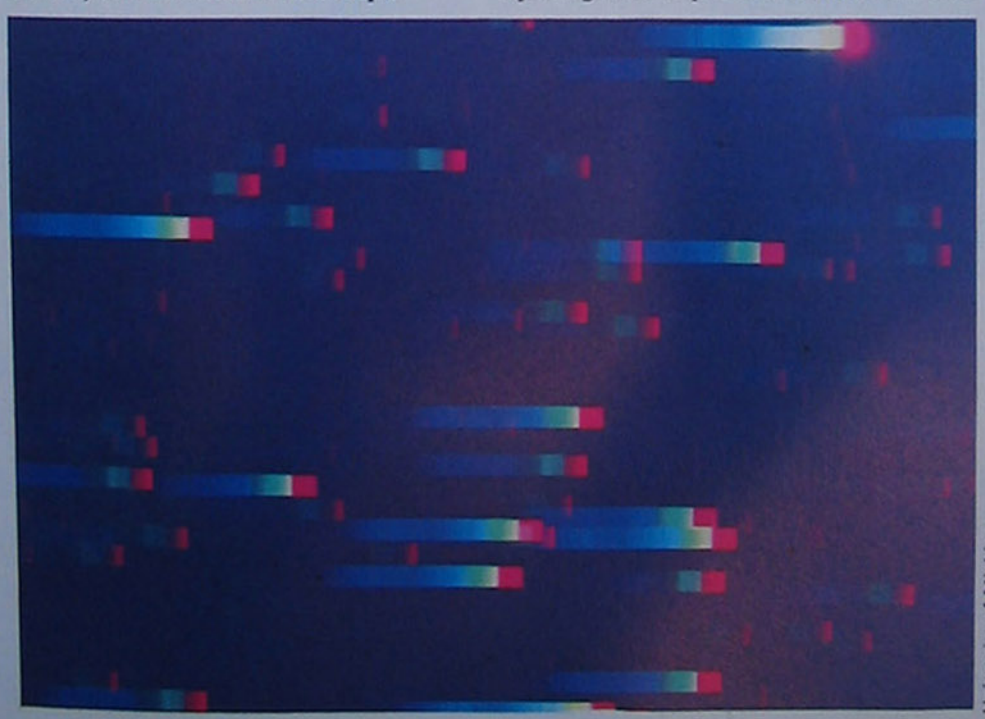
While the latest electronic systems will also store images over a period—it is called *integrating* the light—they are very much more expensive than a photograph. Furthermore, they generally have much poorer definition. On a square centimetre of film can be stored a million 'bites' of information, to use computer terms. This means that the rate at which a photographic emulsion gathers information is incredibly high. And when information—in this case, the dim light from distant galaxies—is sparing, it is important to make the best possible use of it. Despite the inefficiency of the photographic process, including such complications as *reciprocity failure*—its poorer efficiency at low light levels—photography remains invaluable to the astronomer.

The importance of photography to the astronomer is underlined by the effort which photographic scientists put in to help the astronomer. For the problems of detecting faint stars against a background, without suffering from the coarse, grainy results of fast film, are a great challenge to the photographic scientist.

A single photon of light—in effect, the 'particle' of light—has travelled for possibly thousands of millions of years through space from a remote

Novosti Press Agency

Russian giant *The world's largest telescope in its dome. The mounting allows it to track stars precisely for several hour time exposures*



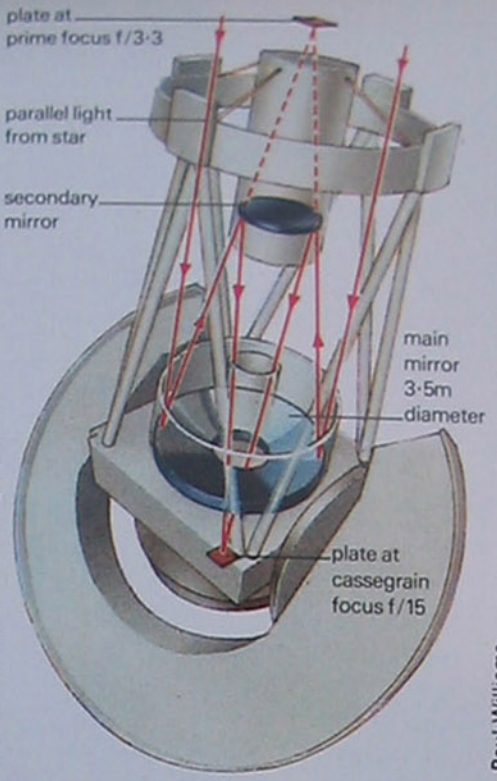
UKSTU/Royal Observatory, Edinburgh

Orion Nebula *The colour of this red gas cloud—the birthplace of stars—is characteristic of hydrogen. This was taken by the UK schmidt Telescope*

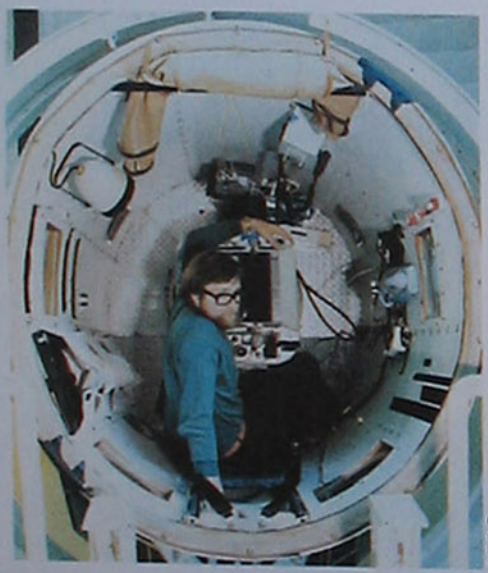
University of Michigan

Starlight messages *One common use for photography is in recording star spectra. Each star image is split into colours, the dark lines revealing constituents of the star's atmosphere. Hydrogen lines show up strongly*

Royal Observatory, Edinburgh (SERC)



Paul Williams

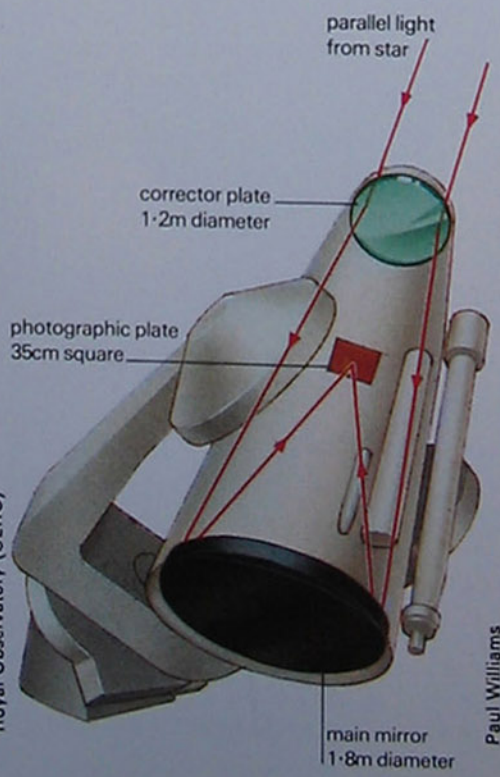


SERC

Telescope systems *Above is the Anglo-Australian Telescope, with its optical system shown in red on the diagram. The main mirror, of 3.8 m diameter, focuses light to the prime focus, shown dotted. The photographic plate may be placed here, at the f/3.3 focus. Alternatively, a coarsegrain mirror can be used to reflect the light down through the central hole in the main mirror. This gives f/15 and an effective focal length of 57,000 mm. At left, photographer David Malin sits in the prime focus cage*

Schmidt design *The UK schmidt telescope in Australia (below) has a 1.8 m main mirror and a 1.2 m corrector plate at the top of the tube. The plate is inserted in the middle of the telescope*

Royal Observatory (SERC)



Paul Williams

galaxy. Other photons from the same galaxy have been travelling parallel with it for all that time, but separated from it by some distance. Those that enter the telescope are reflected from its main mirror in such a way that their paths converge on a single point on the photographic emulsion, which may be on either a film or a glass plate. It is at this point that the photographic scientist becomes interested, because the exact process of making a silver halide grain developable is being tested to its limit. And the efforts of research laboratories have literally doubled the size of the observable universe over the past couple of decades, by making improved emulsions.

Oddly enough, the new emulsions are not faster than the old ones. But they give an improved chance of being sure that a star or galaxy can be detected against the background of general light from the sky and chemical fog on the photographic plate or film.

In addition, there are new ways of improving the speed of the emulsions immediately prior to actually using the plate. There is always a battle between making plates as fast as possible and ensuring that they will keep long enough to be used. Most emulsions are manufactured with additives that will prevent them from fogging spontaneously, and for many years it has been common practice among astronomers to bake their plates for eight hours prior to using them. The baking—carried out at about 65°C—drives off many of the preservatives and leaves the emulsion in a high state of readiness to be triggered off by any incoming photons.

Recently, however, further techniques have come into widespread use. The most successful is bathing the plates in an atmosphere of hydrogen gas for a period of 12 hours. This has the effect of removing most of the water vapour in the emulsion, with gains in sensitivity. As hydrogen is dangerously explosive a safer method, almost as good, is to use *forming gas*—a mixture of a small percentage of hydrogen in nitrogen, which is virtually harmless.

These techniques are known as *hypersensitization*, or 'hypering'. Together with improvements in emulsions, they have made fainter stars visible using the same instruments as before—as effective as building a whole new generation of monster telescopes. Indeed, nowadays it is possible for a comparatively small telescope run by a college or university—with an aperture of, say, 60 cm—to take pictures which are the equal of those made using what was the world's largest telescope before World War 2—the 2.5 m reflecting telescope on Mount Wilson, California.

Today's telescopes, however, are larger still. All big telescopes are of the reflecting type, with a concave mirror to focus the light rather than a lens. Mirrors can be made much larger than lenses, and do not suffer from false colour. The world's largest, at Zelenchukskaya in

the Caucasus, has a mirror six metres across; next largest is the five metre telescope on Mount Palomar, California. There are several telescopes with mirrors about four metres across, including two in Chile, one in Australia, one in the US and the latest, soon to be producing results, in the Canary Islands.

As well as the giant telescopes—in effect enormous telephoto lenses, with fields of view or under a degree (twice the diameter of the Moon)—there are smaller but equally important instruments called *schmidt cameras*. While these have smaller apertures—usually around one metre or less—they are designed to give the highest quality images over a rather larger area—a full six degrees or so. The schmidts are the wide angle lenses of astronomy, though their field of view is about the same as that of a 500 mm lens on a 35 mm camera.

An original schmidt plate can be staggering to the imagination. A typical plate is 350 mm square—about the size of a table napkin—and is covered from edge to edge with star images. There are frequently as many as one million on each plate. Using a powerful magnifier reveals more and more, down to tiny specks. Each one of these specks is a sun in our own galaxy.

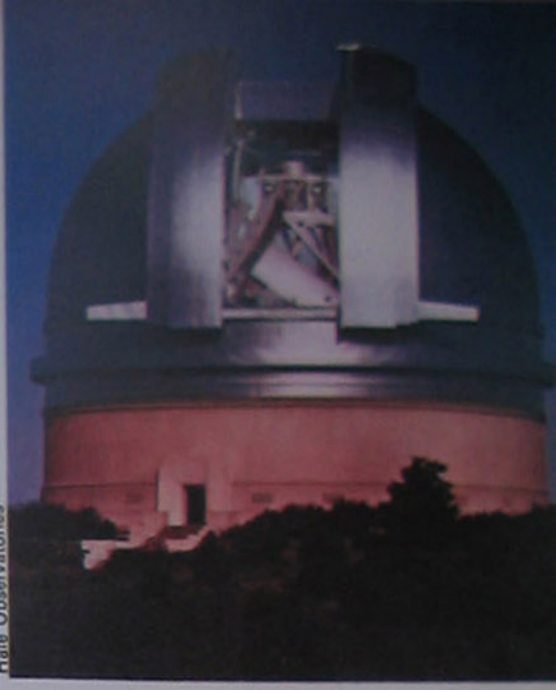
The plate is almost always a black and white negative. Only rarely do astronomers bother to make prints because it is easier to see dark stars against a light background than the other way round.

Among the stars are occasional dark blurs, often disc or spindle shaped. On closer examination these turn out to be other galaxies—distant star systems beyond our own. Also visible are more widespread blurs of light, often woven into intricate wisps. These are *nebulae*, clouds of gas in our own galaxy.

During the 1950s a set of photographs covering the entire sky visible from California was taken using the 1.2 m schmidt telescope at Mt Palomar. This has become known as the Palomar Observatory Sky Survey, and is still one of the astronomer's most valuable reference works. Recently the coverage has been extended to the whole sky using similar telescopes in Australia and Chile.

Each of the thousands of Sky Survey areas is photographed on two separate black and white plates. One is blue sensitive only, while the other is panchromatic and is used with a filter so that it covers the red part of the spectrum. By simply comparing the images on both plates, it is possible to establish something about the nature of a star, since an object's colour depends on its surface temperature. Hot, young stars are blue while cool, old stars are red. The sky survey is often used to establish which objects deserve further study with the very large telescopes. It also helps in the identification of objects picked up by radio astronomers in their surveys. For example, during the 60s radio astronomers found many point sources of radio waves in the sky which the Sky Survey showed to be starlike objects, brighter on the blue plate than on the red. Eventually further study revealed that these were enigmatic objects now called *quasars*, which include the most distant objects ever discovered.

Although many astronomical photographs are taken in different colours of light in this way, it is quite rare for colour emulsion to be used for scientific purposes. One reason for this is that ordinary colour emulsions suffer badly from reciprocity failure, while the emulsions used by astronomers are usually designed to suffer less from this. But a number of photographs are now being taken using three separate plates, filtered so as to be sensitive to blue, green and red light. By combining these images in straightforward tricolour printing, a full colour picture results.



Hale Observatories

Hale telescope *The five metre (200 inch) telescope at Mt Palomar is the world's second largest conventional telescope*

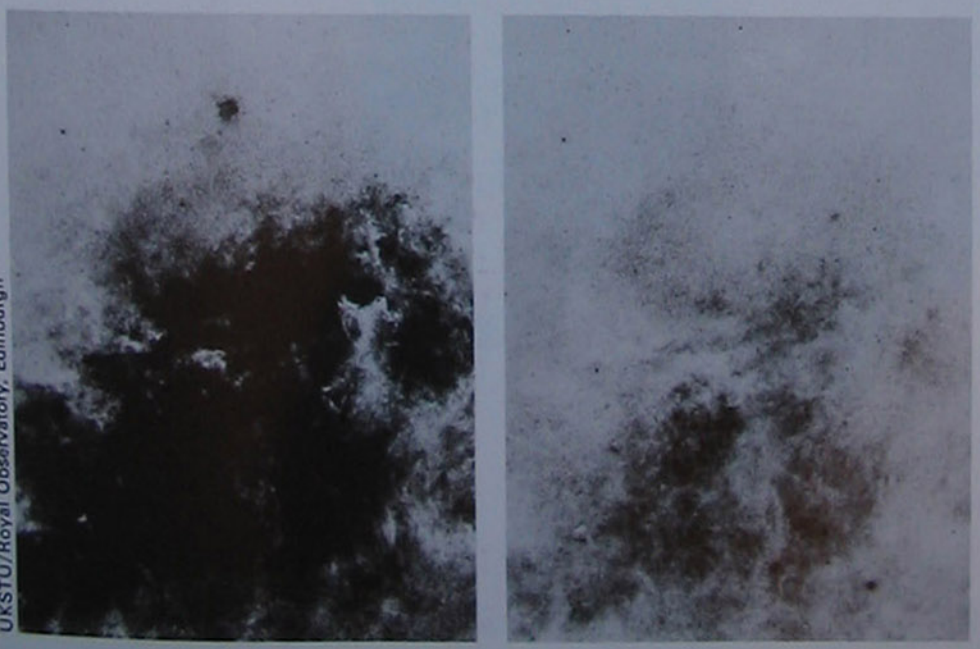
A further advantage of this method is that it gives much more accurate colours as far as the eye is concerned. An object such as the Orion Nebula appears green to the eye, but red on a colour photograph. This is because colour emulsions are particularly sensitive to the red wavelength of hydrogen gas in the nebula, while the eye is more sensitive to the green of nitrogen and oxygen. Using the three plate method it is possible to make a print that shows the nebula in its 'true' colours—though such objects are so dim that the eye sees little colour anyway.

In fact, the colours shown in photographs, while quite genuine, can usually never be seen by eye, even in giant telescopes. Although colour pictures are spectacular, and often reveal significant features of the objects, it is not necessary to make colour prints to see what is going on, and most astronomers are happy with black and white plates.

One reason for this is that telescope time is very much at a premium. The giant telescopes are booked up months in advance and an astronomer is usually allocated, say, just three nights on a telescope. If it turns out to be cloudy, or if something else goes wrong, it is just too bad. Given these conditions, it is hardly surprising that astronomers prefer to take two plates rather than three, and to use black and white in place of the less efficient colour emulsion. Exposure times are generally many minutes long, and an hour is not uncommon.

For that period, the telescope must be guided very precisely on the object being photographed, to counteract the Earth's rotation. At one time the astronomer would actually sit at the top of the telescope at what is called the *prime focus*, peering through an eyepiece at a guide star. If the star drifted away from the centre of crosswires the astronomer would use controls to correct for the

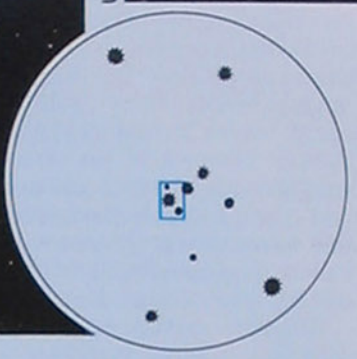
Red and blue *These negative prints from the UK schmidt survey show the same small region of sky in red light (left) and blue light. The red print shows wisps of gas while, on the blue print, the hot, young blue stars show up better*



UKSTU/Royal Observatory, Edinburgh

UKSTV Royal Observatory, Edinburgh

Kitt Peak National Observatory



drift and keep the star image perfectly circular. This work was tedious and often cold and lonely.

Today, however, most large telescopes have electronic autoguiders, which make life much less boring and allow the astronomer to sit in a heated control room. The telescope is maintained at the outside temperature to prevent warm air from flowing through the open slit in the dome and creating turbulence in the telescope's line of sight, which would affect the image.

Most plates are loaded individually into the telescope before the start of each exposure. Only rarely is roll film used, as the special astronomical emulsions are not made in roll film sizes large enough to be of use.

Processing of the exposed plates is usually carried out as soon as possible after the exposure, no later than the following day. Astronomers generally use conventional developers, such as Kodak D-19, which is an active developer well suited to developing grains which have had a long exposure time. The silver specks which it develops tend to be on the surfaces of the grains if the light was dim, while brief, bright exposures tend to give development centres deeper within the grains. Other developers have been made specially for astronomical work, including two devised at the Mount Wilson and Palomar Observatories, which are therefore known as MWP-1 and MWP-2.

The most commonly used emulsions are scientific plates in the Kodak Spectroscopic series. The Palomar Observatory Sky Survey was made on 103a-0 (blue) and 103a-E (red) plates, for example, and these are still widely used. The small 'a' in the description indicates that the emulsion is suited to astronomical work.

More recently, the IIIa-J panchromatic emulsion has become popular. This is slower than the 103 plates, but is more efficient at revealing faint objects if longer exposure times are given.

A photographic scientist is supposed to have made the following wry comment on astronomers. An astronomer, he maintained, was someone who used a large and expensive telescope to expose a plate which was the result of years of research and expertise. Having done this, he would dunk the plate for a while in some brownish fluid, transfer it to a slightly less brown liquid, and use the result to draw profound conclusions about the Universe.

Today's astronomers, by and large, take rather more trouble over their work. And the results often make the imagination reel.

Horsehead nebula *To the eye, this region of Orion contains a few stars (see map). But a schmidt telescope plate reveals glowing gas clouds. The dark region in the wisps at the centre gives the 'horsehead' its name*
Galaxies *This small group, known as Stephan's Quintet, was photographed with the 4-metre telescope at Kitt's Peak, Arizona. Deep space objects like these are faint and require long exposures*
Spiral *A view of the spiral galaxy NGC 1566, taken with the Anglo-Australian Telescope*

Anglo-Australian Observatory

What went wrong?

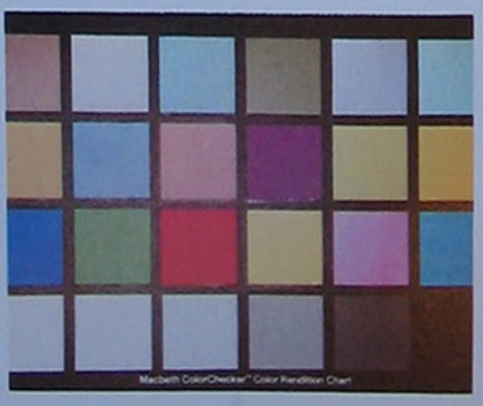
Instant picture problems - 2

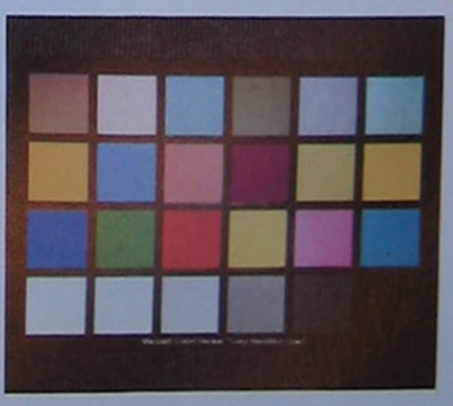
Instant picture film colour will remain constant only as long as the conditions of storage, exposure and processing remain unchanged

These pictures were taken to simulate the effects of cold on the image quality. The print on the left was left in the cold from the moment it was taken, while the other was put into a warm pocket. The colours of the 'cold' print did not change from their generally muted nature when the print was returned to the warmth

This set of pictures simulates the effect of high temperature. If you were to take an instant picture and left it to process, after ejection, on a warm shelf, or the back shelf of a car in direct sunlight, the quality of the image will be impaired (left). Results are much better if the picture is processed in a cooler place

Instant picture cameras can yield rather lifeless and disappointing colours. If you have a flashbar or electronic flash, you may improve results by using flash even in broad daylight, particularly in overcast weather, or when it is sunny with very stark shadows. It is worth experimenting to establish which setting of the exposure control suits this technique





If you do a great deal of flash photography with an instant picture camera, it is usually worth experimenting with the exposure 'lighten/darken' control. This sequence of pictures shows, on the left, a fairly close-up picture taken by electronic flash, at the 'normal' mid-point setting of the exposure control. Colours are rather washed out. However, by turning the control first to one notch darker (centre), then two notches darker (right), significant improvements are made

DILSTON HALL

Group practice

Group photography is a challenging subject, and much less straightforward than the single portrait study. But whether you take a candid or formal approach, there is plenty of scope for imaginative photographs

Many people think of group portraits as something akin to the football team photo or the standard wedding shot of family and friends—pictures so straightforward and obvious that they seem to have nothing to do with creative photography. But even in these formal shots there is considerable scope for the exercise of imagination and skill, and group shots can be far more than this. You only have to look at a few modern record covers to appreciate just what can be done with four people, a few props and a little imagination.

Whether the shot is candid or posed, formal or informal, group portraits provide a considerable challenge to the photographer's ingenuity—while it is difficult to capture a single person effectively within the frame, it can be even harder to photograph two or more people well. Although there are obvious similarities between group shots and single portraits, the basic approach can be quite different. While with portraits the aim is often to capture some facet of the sitter's personality, with group shots the individual personality tends to be less important and the photograph is more about group identity and the relationship between the various people in the group. This may seem self-evident, but it is surprising how often it is forgotten.

Although with candid shots it is not so helpful, thinking about the group identity and the relationship between the individuals can provide a number of clues to the best approach for posed shots whether formal or informal.

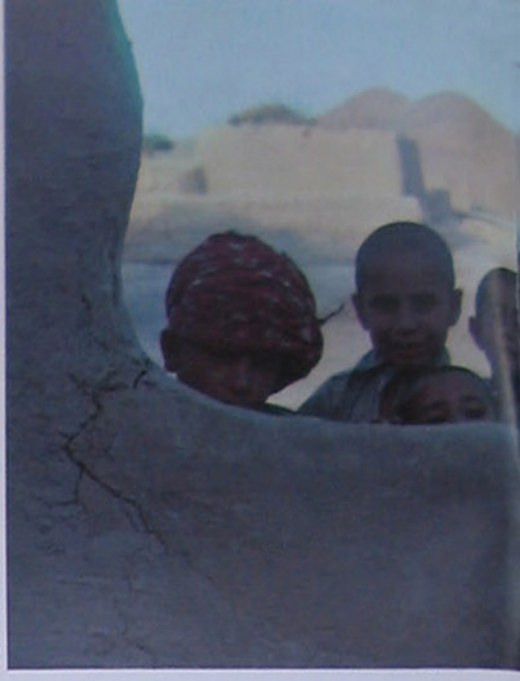
In a relaxed, family situation, for instance, a rigid formal arrangement is clearly inappropriate; the grouping should look casual and informal in the photograph—even if it does take careful arrangement to achieve this effect! Rather than sitting upright in a formal row on the sofa, have someone sitting on the floor, someone else on the arm and so on. Arrange the group so that the faces are all at different heights rather than in a line. And try a slightly unusual viewpoint as well—either higher or lower or to one side—to tone down the posed look.

With any informal group, it helps to move the people close together in a tight knit unit—great spaces between people either make the composition look weak or give it a cold, formal look. With a group of three, one person could put his arms round the others to draw the group together.

For a shot of the board of directors or a club committee meeting, a more formal approach may be required and neat rows of heads may not be inappropriate. There may be a very definite hierarchy in the group that should be brought out in the shot. It may be important, for

Ballerinas *Occasionally a group falls into an attractive arrangement quite naturally, without directions from the photographer. In this case, make sure your viewpoint makes the most of this, giving a clear view of each face*

John Sims



Mechanics *Some people will be uncomfortable if you try to arrange them into a formal group, but if you find a prop natural for that particular group you will find that people arrange themselves easily and informally around it*

instance, to show who is boss. Although the obvious answer is to put him or her in the centre, there are many other often more effective approaches. If the boss is to be really dominant—almost aggressively so—you could shoot him or her very close up with a wide angle lens. For a more equitable arrangement, the group could be posed on a staircase with the boss either at the top or standing slightly to the side.

Clearly, then, the treatment should suit the group and, before you start to move people around, it is important to establish just what kind of result you are trying to achieve. For most group shots, an 'artistic' treatment is inappropriate. An elaborately arranged shot of the lads at work is not only virtually impossible to set up in face of the ridicule but the result also looks rather strange. A simple, casual group works better.

If you are asked to take the team photograph on match day, on the other hand, it is a record shot that is wanted and the traditional formal grouping is better than anything casual. However, there is no reason why you should not take a series of candid or informally posed shots after the match is over—the jubilation of victory should help to give a natural, happy expression.

One of the most important features in group portraits is a focal point. It is

John Sims

Monty Python team *Posing a number of people on steps is a traditional, but effective, way of ensuring that you obtain a good view of everyone. With groups who seem self conscious try to divert their attention elsewhere, so that they may relax, rather than staring into the camera*

On the bench *A telephoto lens allows you to photograph a candid group from some distance away. If you have time, choose your position carefully, so that you can exclude anything, by selective framing, which does not contribute to the composition*

Richard Emica

Boys *You can use a convenient prop, if necessary, to draw people together into a more coherent group*

Gered Mankowitz

Pop group *This photograph, used for a record cover, has been arranged into different sections to help suggest the different personal ties and talents of this group's members*

often important that the group is drawn together visually and a strong centre of interest may help to do this.

Sometimes there is an obvious centre of interest. At a small christening party, for instance, the baby is clearly the star of the show. The centre of attention does not need to be right in the centre of the picture—it only needs to be the visual focus. Instead of lining up the party facing the camera, arrange the group so that mother and child are the visual focus. The mother, perhaps, could be cradling the baby while all the party crowd round, leaning forward to look at it. The camera then, is just another observer in the group and because people are not staring directly at the camera they are far more relaxed. The result can be natural and attractive.

If there is no obvious centre of attention, you could arrange the group around an artificial focal point. Set them around and on a bench, around a table or by a tree—something that brings the group together visually.

Another way of bringing the group together visually is to arrange them against a background that seems to enclose them—a doorway is an obvious example, but there are many others to be found. Alternatively, arrange the group more deeply and use a background with

Robin Laurance

Band *Uniform always helps to unite a group and give information about their occupation. In this picture the bright colour also provides a strong contrast to the dull background*

Steve Benbow/Network

strong converging lines of perspective to draw them together. You could sit them on stairs for example, or shoot from a high viewpoint within a narrow alley with a fairly wide angle lens.

Of course, other, less obvious, unifying features can be used. Look for patterns and arrange the group to emphasize them. Even lines in the picture can be used to draw the people together visually. A bare arm, for instance, could lead the eye from one face to another. A light-coloured scarf might do the same. If the people are wearing small but similar items of clothing—similar either in colour or shape—the effect may be the same.

The background is particularly important. Either it should be as plain and undistracting as possible or it should contribute positively—setting the group identity. Clearly, group shots should be in an appropriate setting. If you are photographing a group of airmen, the logical place to arrange them is around an aircraft: if you are shooting a group of butchers, photograph them in their shop.

Often, shooting the group in context may present considerable technical problems—work and social settings tend to be indoors, for instance, and light levels may be low. But it is generally worth trying to overcome these problems to give the shot atmosphere.

Try to shoot by available light if possible rather than adding flash or studio lights—it is important that the lighting looks as natural as possible. This usually means that a tripod is essential, for exposures may be very long—particularly if you use slow film to retain as much colour and detail in the setting as possible. It can also mean that the people you are photographing may have to remain completely still for a matter of seconds. So try to arrange them in comfortable, relaxed poses that they can hold easily for long periods. This often ensures that the photograph looks more natural as well.

If you do have to add supplementary lighting, try to match it in character to the available light. In a modern room with fluorescent lighting, for instance, the harsh white light of flash may be appropriate. In an old, mellower room, yellower tungsten light might be better.

Of course, the setting need not always be 'natural'; you can choose an alternative setting that says something very definite about the group. Publicity shots for rock musicians, for instance, are usually intended to create a particular image. A group is set in a derelict industrial area and photographed with sullen expressions to suggest that they too, like their potential audience, are 'alienated' from society and rather bitter about it. Or they are photographed in a slick plastic and metal environment full of shimmering surfaces and primary colours to give a glamorous modern image.

Clearly you can give the same treatment to rock groups, but many other groups have, or would like to have, an image. Businessmen, for instance, might like to be shown as efficient and up-to-date and may be disappointed if you photograph them in the oldest, most untidy office in the building. Try to choose the setting to suit the image of the group and pose them in a way that emphasizes the image.

Another approach often used on

Art class *A large group is usually more difficult to arrange and pose, but it helps if you have the chance to photograph people in their own environment where they fall into natural positions, giving a more relaxed atmosphere*

Michael Hoppen

modern record covers is to combine separate—and often strange—portraits of the group members in a single picture, relying on the similarity of treatment and the similar appearance of the members to draw the picture together. The combined portraits can be arranged to give a strong pattern. You do not necessarily have to make combination prints (see page 360) to achieve the same effect. A single shot of the group with each peering through a natural frame—such as the different panes in a window, gaps in a fence or the holes in a modern sculpture—can provide a similarly strong image.

Formal group portraits present the photographer with other difficulties. If you are dealing with large groups the problems of organization become increasingly important. Some of the group may be less cooperative than others, and there can be a small percentage who are deliberately awkward and do exactly the opposite of what is required. Others may be tired, cold or bored. All these different factions have to be welded into a single unit by the photographer.

When you are in the final stages of arranging a number of people into a group portrait, it is a good idea to expose a few frames of film without their knowledge. Often these 'grabbed' shots are more effective than those when everyone is tensed and waiting for the important shutter click. By choosing your moment carefully when everyone is in position but has not been called finally to attention, you may get interesting, animated and amusing expressions and gestures which would otherwise be curbed by the formality of picture-taking. But always shoot a few straight-on, simple and uncomplicated pictures for those who may not be amused by a less formal approach.

Photographers who frequently photograph groups, such as at weddings, have a repertoire of off-beat or amusing approaches calculated to make even the glummest persons smile. There is no doubt that on happy occasions, the best pictures are those where everybody is laughing at some unexpected event, even if they are not looking at the camera.

The technical aspects of group photography are important, particularly if you are dealing with large numbers of people in unfamiliar surroundings. The relationship of numbers of subjects to frame size often demands a wide-angle lens. If so, remember that the greater the angle, the greater the distortion, especially towards the edges of your frame where people may be unpleasantly stretched out. So avoid composing too tightly at the edges of pictures taken with extreme wide-angle lenses. If you are confronted with a really large group, and are not happy with shooting on a wide-angle, make sure you have an exactly level tripod and shoot two frames side by side on a normal lens. Your tripod has to be dead level so that the two prints will exactly match in terms of angles and perspective. If employing this technique try to composed so that the join between the two images occurs along a natural break or line in the composition—the corner of a fence, the side of a building and so on.

Jerry Young

Pilots *Sometimes a more formal arrangement is appropriate to a particular group. Here the photographer has made imaginative use of the plane, using a high viewpoint, and arranging the men in formation, so that you know who is in charge*

Remember to organize your lighting requirements beforehand, and this is particularly important when photographing groups indoors. Do not rely on a single flash attachment as this can produce large exposure differences between the people at the front and centre, and those at the back and edges of frame. Employ additional lighting to supplement existing flash if necessary. Make sure that every face in the group is clearly lit, and that the shadow of one person does not obscure any important feature of another.

The fact that a photographer is always composing pictures within a defined frame allows you the freedom to bring apparently disparate elements together in an entertaining and unusual way. People crowding in a picture gallery are not necessarily part of a group, but you can make them appear to be related by your choice of framing. Five people sitting on a park bench might never have seen each other before or since, but your photograph will unite them as a single unit forever. This allows you great scope for humour, irony, social comment and pure human observation. Be constantly on the lookout for unusual juxtapositions. Your eye, through the camera viewfinder, can isolate or expand, and once these possibilities have been appreciated, the number of informal and casual groups which come together for the split second when the camera is on them is literally endless.

Advanced focusing

Focusing a camera on a static subject, or a willing model, is usually easy. But what do you do if your subject is moving, or reluctant to be photographed?

Sally & Richard Greenhill

Inaccurate focusing probably spoils more photographs than any other technical fault. Most modern cameras automatically set the correct exposure, but usually leave the user to set the focus. Under most conditions focusing is relatively simple—you decide what to focus on (see pages 86 to 89) and then set the appropriate distance on your lens, using whatever focusing aids may be built into your camera. However, there are occasions when the conditions or the subject make focusing difficult.

Girl on swing *With moving subjects, preset the point of sharp focus, and shoot when your subject reaches it*

There may be times when you do not wish to make your presence obvious, such as in candid street photography. For such occasions you need a focusing method which enables you to produce a sharp image without drawing attention to the camera by holding it up to your eye and focusing it in the normal way. You may also have to deal with a rapidly moving subject, in which case you will not have time to set the focus. In low light, you may not be able even to see the subject clearly enough to focus properly. At other times, the subject itself may be the problem—its surface texture may defeat the camera's focusing aids, or it may extend beyond the depth of field of the lens you are using. While focusing in such situations is more difficult than usual, there are several techniques you can use to make it easier.

Fast focusing

Parties and street scenes are typical situations where the rapid and irregular movement of the subject can make focusing a hit-or-miss business. Indoors, low light aggravates this, and asking people to stop for the camera destroys the spontaneity of the situation.

If you are using a camera with interchangeable lenses, you can make fast focusing easier by fitting a wide angle lens. This gives you greater depth of field, so that more will be in focus, and also has the advantage that the focusing ring usually rotates through a relatively small arc, making focusing quicker. If you use high speed film with such a lens you can choose a small aperture, thus increasing your depth of field so that almost everything will be in focus.

At parties or similar gatherings, a portable flashgun fitted to your camera can allow you to set a small aperture on your normal or wide angle lens so that you need not worry about focusing at all—you just have to make sure that your subject is within the depth of field of the lens and within the range of the flash gun. If you have an automatic electronic flash, set the lens aperture to match the aperture indicated on the flash calculator dial. Usually the dial indicates a maximum distance at which the flash can be used. If your lens has a depth of field scale, set this distance on the focusing ring opposite the mark on the scale for the aperture you have set. This technique will give you maximum depth of field, allowing you to take photographs at a range of distances knowing that as much as possible will appear sharp.

Take care when using a wide angle lens and a flashgun together—you may need to fit a diffuser panel to the flash head to increase the illumination coverage (see pages 196 to 197).

Zone focusing

For candid photography and for other occasions when you do not want to use flash, there are other ways of ensuring that the subject is kept in focus. When there is insufficient time to focus through the viewfinder in the regular way you can try adopting the method used by some manufacturers of rangefinder cameras, known as zone focusing. Instead of precise distances in feet and metres, symbols are marked on the focusing ring—a head for the close-up setting, a group of figures for the middle distance and a mountain for the infinity setting. When the lens is set for a given zone,

Zone 1 *Focused on 1.1 metres*

Zone 2 *Focused on 1.75 metres*

Roger Payling

Zone 3 *Focused on 3 metres*

Front of queue *With the lens focused on 1.1 m, only the stallholder and the first customer are in focus*

Middle of queue *The second zone of sharp focus includes only the next of the figures in the queue*

Back of queue *With the lens set to the green mark, the first two figures are unsharp, and the rest are in focus*

Roger Payling

Zone focusing *By using preset zones it is possible to make snap judgements about where to set the focusing ring without having to lift the camera conspicuously up to your eye*

all objects within the zone are sharp. Of course this system works better if you are able to benefit from the broad depth of field of a wide angle lens or a small aperture. Focusing becomes very much more difficult to accomplish with this method if a lens longer than 50 or 55 mm is used or if a normal lens is used at full aperture.

If you have a rough idea of how far away your subjects are likely to be, you can identify these distances on the focusing ring so that you can rapidly preset the focus before you raise the camera to your eye. To accomplish this, some photographers use the night photography technique described on page 653. Tape small pieces of matchstick to specific focus positions—in this case, for example, one match might indicate what is likely to be the closest distance to be used on your lens's focusing scale. This is followed by two pieces side by side at a middle distance, and three pieces at a farther distance. Rotating the focusing ring until the appropriate zone is at the 12 o'clock position and aligning the matchsticks with the index mark on the focusing scale by touch, you can set an estimated distance without even looking at your focusing scale.

All this presupposes that you are reasonably familiar with the controls of your camera so that you can handle it literally with your eyes closed. It also assumes that you can make a reasonably good estimate of the distance to your subject. This sort of ability is the result of practice. An hour or so of guessing distances and then checking them against the distances given by the focusing aids in your camera is usually enough to improve your ability considerably.

For candid shots outdoors, there are other methods often practised by photographers who specialize in catching people unawares. One method is to focus on another subject a similar distance away, then turn the camera on to the subject you are really interested in and quickly press the shutter. With a wide

angle lens, you can even include people in the frame without them knowing it. They will think you are shooting past them and are unlikely to realize how much your camera is taking in. Another method involves anticipating where your subject is likely to walk into view. By prefocusing on a point on the ground and waiting for the subject to walk past that particular spot, you can take a photograph very quickly by just raising the camera to your eye at the last possible moment.

Fast moving subjects

Cars, trains, aircraft and other fast moving subjects present special focusing problems. Sometimes the subject may be moving across your field of view at an angle or at a considerable distance, and you have to successfully adjust the focus continuously to keep the subject sharp. This technique is known as follow focusing but can only be employed effectively if the subject is at a reasonable distance away. To make follow focusing easier, Novoflex manufacture a range of telephoto lenses with pistol grips to control the focus. Squeezing the control focuses the lens progressively closer, and relaxing it allows the focus to return towards infinity.

However, if the subject is close or moving more or less directly towards or away from you, you may have to preset the focus, just as for walking subjects. Find a point on the ground that the subject can be expected to pass over and focus on this. When the subject reaches this point it will be in focus.

Roger Payling

Focusing markers *Certain cameras have quick focus rings fitted with movable markers to indicate focus zones*

There is a slight complication, though—if you wait until the subject is in focus before you release the shutter, the brief time delay between pressing the shutter release button and the operation of the shutter mechanism may be enough to let the subject pass out of focus, especically if it is moving quickly. This delay is known as time parallax, and it varies in duration from camera to camera. In general SLRs have greater time parallax than rangefinder cameras since their viewing mirrors have to be raised before the shutter can operate.

The solution to the problem is to release the shutter slightly before the subject reaches the focused point. If, for instance, the subject is a racing car, you may well decide that the driver's cockpit is the most desirable position to have in focus. But if the car is coming towards you at speed, you will need to press the shutter at the moment when the nose of the car crosses the point of prefocus. This will allow for the time parallax so that the cockpit will be crossing the focusing point at the time the actual exposure is made. Consistent success can only be achieved if you practise this technique and learn from your mistakes.

Split image screens

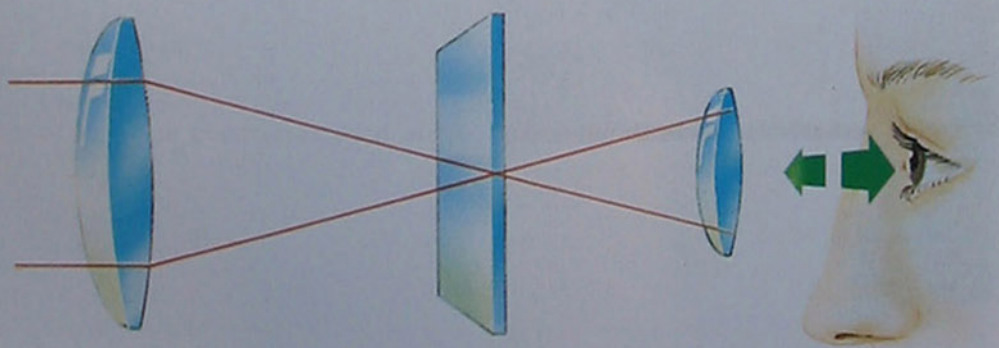
The focusing aids built in to SLRs can cope with most situations. However, there are some subjects that are difficult to deal with even with the combined help of split image rangefinders, microprisms and glass focusing screens.

Cats and rabbits, for example, are often physically uncooperative—they tend not to sit still when you want them to—and their fur is difficult to focus on yet must be really sharp to be effective in a photograph. Fur is impossible to focus with split image rangefinder prisms unless it has a strong pattern. Microprisms are somewhat more effective but can be misleading when you are dealing with long-furred animals at close ranges. Try to focus on the centre of the animal rather than its outline. If you are shooting a portrait of your pet, try to focus on the eyes, just as when you photograph a person.

Some subjects can mislead your focusing system. Split image rangefinders are usually effective with subjects having strong horizontal or vertical lines on their surface, but not when the lines form a regular pattern as with striped wallpaper. In such cases you may find that you have matched the wrong lines of the pattern, giving an image that looks satisfactory in the split image prisms yet is out of focus. With such subjects you should always check your focusing on the matt glass area of your focusing screen.

One difficulty widely experienced with focusing is that one half of a split image screen may black out. This only happens with lenses of a relatively small maximum aperture. But this itself is particularly irritating since lenses with smaller apertures tend to be of longer focal lengths and require more critical focusing techniques. In some cases you will find that this difficulty can be overcome by placing your eye closer to the viewfinder or by using a rubber eyecup. However, often there is no way of improving matters and one of the other focusing aids has to be used. Usually a camera which offers a split image screen also allows focusing to be accomplished by microprisms or by the plain matt glass area of the screen. Cameras with

Parallax focusing



Using clear screens *In certain conditions, it may be impossible to use a matt glass screen, and instead a clear screen with cross hairs is used*

When the image of the subject is in focus, it does not move in relation to the screen if the photographer's head is rocked gently to and fro

Advertising Arts

Roger Payling

Adding light *Sometimes, you may need a light to focus by. Remove it to take the actual photograph*

interchangeable screens can be fitted with the appropriate screen which will make focusing much easier (see page 723) for certain subjects.

Using a tape measure

There are occasions when the easiest way to overcome focusing problems is to measure the distance from the camera to the subject with a tape measure. Dark subjects, for instance, can be particularly tricky to deal with. However, in such cases you can try to bracket the focusing by taking several exposures with the focusing ring moved slightly between shots.

If your subject is close and stationary you may find it easier to measure the distance and to set this distance on your focusing ring.

To make certain that this is done accurately, the distance should be measured from the most important part of your subject to the film plane. The location of the film plane is indicated by a mark which is usually scribed on the top plate of the camera.

Where possible, a simple solution to focusing on dark subjects is to shine more light on to the subject while you focus. After focusing, the extra light can be removed or extinguished while the exposure is made. Additional light can be supplied by a mirror, domestic lights or a torch.

Roger Payling/lens courtesy of Novoflex

Fast focusing *Novoflex lenses have an ingenious squeeze-to-focus action that makes follow focus techniques easier*

Autofocus problems

There are two main types of autofocus systems—active and passive (see page 642). Both are likely to make mistakes under some circumstances. Active systems work by emitting a pulse of light or sound and computing the distance to the subject either by measuring the angle at which the pulse is reflected, or in the case of the Polaroid Sonar system, the length of time taken for the pulse to return to the camera.

In either case, if the subject does not act as a suitable reflecting surface for the pulse from the camera, results may be unsatisfactory. With the Sonar system, some hard surfaces at an angle to the line of sight can reflect the sound pulses away from the camera altogether, leading the camera to set focus at infinity. The only practical way to avoid these problems is to make sure that there are no steeply angled surfaces within your field of view, and that you do not exceed the close focusing limit of your camera.

Passive autofocus systems are just as prone to error. Most work by detecting subject contrast, although mechanical details may vary. All need light to operate, and some may not be able to focus in light levels that are still bright enough for ordinary photography. Flat, even surfaces without much subject detail usually defeat contrast measuring systems. Some systems are sensitive to the angle of lines on the subject, and may work better when held vertically rather than horizontally.

Both active and passive systems are often fooled by intervening objects such as foliage, bars or panes of glass. Fortunately, most autofocus systems can be manually overridden.

Understanding...

Dye transfer

High quality, long lasting images which can be modified and reworked to a very high standard during printing are features of the dye transfer process

Modern colour materials are capable of producing pictures with a superb range of colours and tones. But there are photographically based processes available which can produce even more impressive results. One of the most important of these is *dye transfer*, which uses coloured dyes printed on to paper or film to form the final image.

Dye transfer allows colour prints to be made from colour transparencies, colour negatives and, if the right equipment is available, from objects and paintings. It gives luxuriously deep colours, and it is possible for the experienced photographer to correct colour biases or contrast problems which occur in the original transparency or negative.

The dye transfer process is used a great deal by professional retouchers, particularly for advertising work. Although a wide variety of retouching techniques can be employed with normal photographic transparencies, dye transfer prints have the advantage of offering several stages at which alterations can be made.

The densities and contrast of each colour component can be individually altered. It is also possible to control just parts of a picture by the use of masks in conjunction with the separations. For example, the cyan component of an area of sky can be increased without affecting the rest of the picture.

To some extent, R-type prints (Cibachrome and Kodak R14) have replaced dye transfer because they are easier and cheaper. But dye transfer is still used for the quality it gives. The dyes can be carefully chosen and used, and the photographer can make sure that they are in top condition. With normal photographic materials, the dyes are contained within the film or paper and are formed during processing. Unlike the dyes used in dye transfer, they cannot be directly controlled by the photographer. The control possible with dye transfer helps enormously when trying to achieve maximum quality and permanence.

Felix Smith

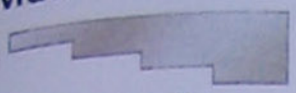
Colour change *Dye transfer involves several stages and so there is great scope for retouching, particularly for changing just parts of the pictures like the car above*

In some respects, dye transfer resembles graphic reproduction processes (see page 1128). For transparencies, paintings and objects, the first step in the process is to photograph (or rephotograph) the original three times to produce *colour separation negatives*. With colour negatives, the separations are unnecessary. The separations are made to the size required for the final picture on panchromatic film—that is, film sensitive to light of all colours—exposed through trichromatic filters of red, green and blue.

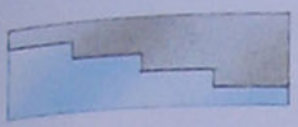
As with other colour processes, the image produced by the red filter is eventually printed in cyan, the green separation is printed in magenta, and the blue separation is printed in yellow. A great deal of care is taken at this stage to ensure that the densities of negatives are balanced, otherwise a colour bias will result. However, some imbalance may be deliberately introduced in order to correct or change the colour.

From these separations, or directly from colour negatives, three positives are

Matrix film



Separation negative *Different densities represent tones*



Processed matrix film *The gelatin hardens relative to exposure*

Finished matrix *The unhardened gelatin is then washed away*

made on *matrix film*. These are then used to transfer dye to the final print. Matrix film is specially designed for the dye transfer process because it needs a film base that will not stretch or distort—if it did, the register of the three colour images might be spoiled. Another feature of matrix film is that the gelatin dissolves in warm water.

There are two types of matrix film—ordinary and panchromatic. Ordinary (blue sensitive) film is used with colour separation negatives which are contact printed on to the matrix film to produce positive images. Matrix films are always exposed through the base, and in the case of blue sensitive materials, the film is dyed yellow to prevent undue penetration by light.

Panchromatic film is used when working from direct original colour negatives. In this method, the image is projected directly on to the matrix film through the trichromatic filters to form the three positive images. There is no need for separation negatives with panchromatic matrix film—but with no colour separation negatives, colour corrections are difficult to make.

The exposed matrix films are subsequently developed in a *tanning* (hardening) developer, and then fixed. In those areas which have been exposed to light (corresponding to the dark tones of the original subject), the gelatin of the matrix film hardens. The hardened gelatin is then washed away in warm water.

The hardened gelatin which is left behind is present in proportion to the density of colour in that area. This is because the tanning action of the developer works in proportion to the amount of silver in each area of the photographic image. For example, in an area corresponding to a dark tone in the original, a relatively thick layer of gelatin is left. In an area representing white, there is no gelatin.

In the third and final stage, the matrix films are dyed in their appropriate colours by immersion in dishes of specially prepared dyes. The amount of dye taken up by a particular area of the image depends on the density of the gelatin. In this way, the thickness of the gelatin controls the amount of dye used to make the print.

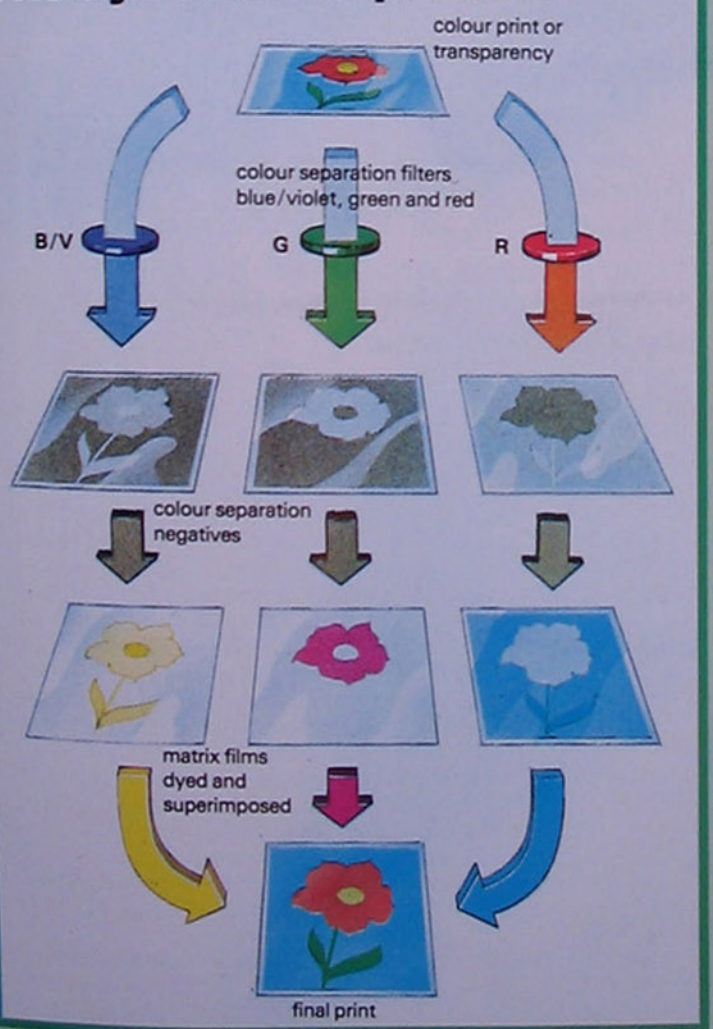
The surface on which the print is to be made is prepared with a special conditioner known as a *buffer*. This is alkaline and is designed to 'attract' the acidic dyes. The image is then printed by pressing the three films on to a special gelatin coated paper or film, using a rubber roller. This transfers the dye from one surface to the other. The films are applied one after the other and in register. The matrix films are then washed so that they can be redyed and further prints made.

By printing the three sets of dyes together, a full range of colours and tones can be built up. This is similar to graphic reproduction processes but without a half-tone screen. It is possible to alter the dyes to increase or decrease the contrast by addition of the appropriate acid or alkali. This can be done after the first print has been made, so that it can be checked before any alterations are made.

Gavin Cochrane/print courtesy of the Kodak Museum, Harrow

Exhibition print *The dyes in dye transfer prints are very stable and so are fairly resistant to fading*

The dye transfer process



Paul Williams

From transparency to print *Black and white separation negatives are made using trichromatic filters. These are then printed on to matrix film, and these matrices are dyed in the appropriate colours. The final image is formed by printing these matrices in succession on to the paper*

World of photography

Michel Tcherevkoff

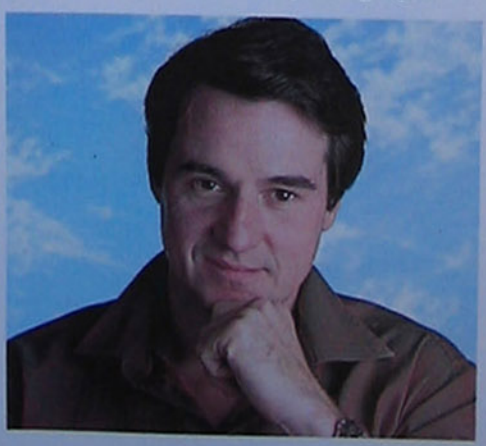
The eye-catching and sometimes startling images produced by leading advertising photographer Michel Tcherevkoff are all created within the confines of his New York studio

Advertising in the pages of a glossy magazine is an expensive and precarious business. If it is to succeed, an advertisement has to make the casual reader stop and look again—it must stand out from all other eyecatching images in the magazine. An advertising photographer who can produce this kind of image can command a high price, but the competition is fierce.

To reach the top ranks of advertising photography—particularly in a large, glamorous city like New York—requires some exceptional talents and skills. Although still only in his 30s, Michel Tcherevkoff has attained these heights and now commands the prestige assignments and top earnings granted to a relatively small group of commercial photographers.

Tcherevkoff's pictures are certainly striking and unusual. Indeed they seem to defy the laws of nature! Everyday objects are transformed into fantastic science fiction images. Solid objects float in mid air in strange and exotic landscapes, or seem about to fly off into space. By adding glamour and excitement to mundane objects, Tcherevkoff's surreal images arrest the eye in the way that all advertising shots should.

So exotic are his images that it seems he must have staged his photographs on a grand scale in far-flung locations. In fact, they are all photographed in his Manhattan studio. His effects are created by using a highly individual blend of imagination and technical wizardry for which he has an international reputation.



Although now highly successful Tcherevkoff began his career through a chance meeting. He had grown up in Paris with his Russian parents, but in the 1960s he left them and all thoughts of higher education to travel in Europe.

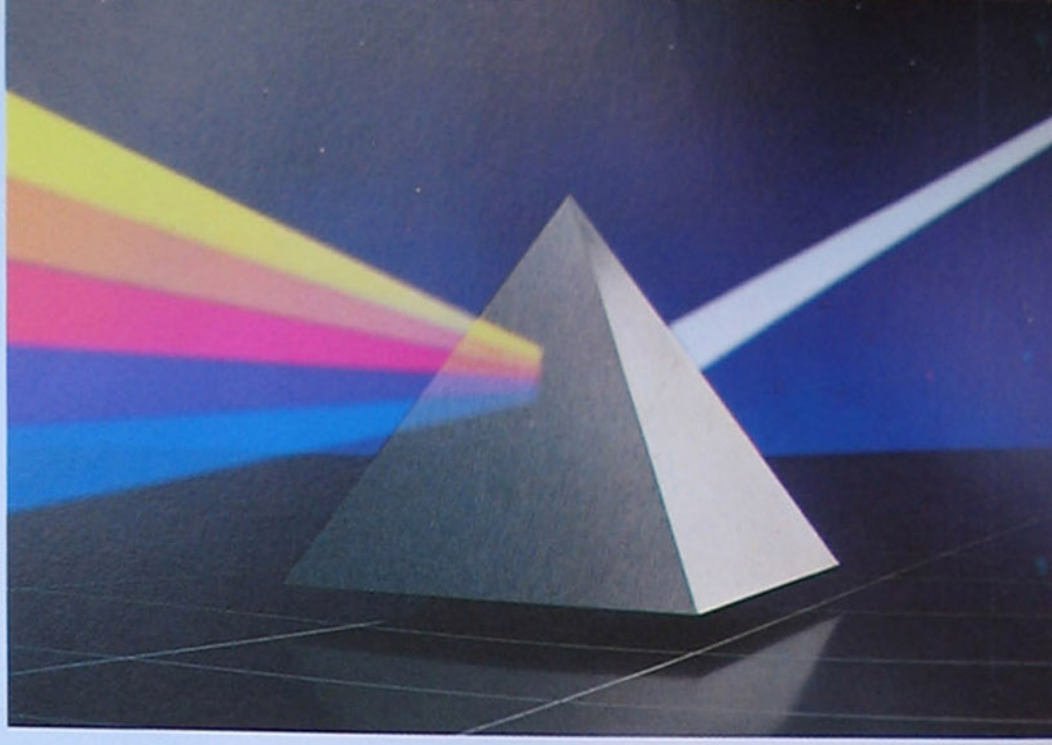
Shortly afterwards, Tcherevkoff went to the United States as a tourist to visit his sister in New York City. Still a teenager, Tcherevkoff was captivated by life in New York and the lifestyle of his sister's boyfriend, a fashion photographer, seemed the peak of glamour. Tcherevkoff made up his mind to pursue a career in photography.

Tcherevkoff learned his profession by working for five years as an assistant to a number of different photographers. He still feels that this is the best training

for a young photographer even if they have already studied photography.

'You have a couple of ingredients when you come out of school. But until you put these ingredients together you don't learn. At college you learn all about colour and how to print and so forth. But when you start to work with somebody good and whose work you respect, you realize what photography is all about. It's doing creative work and then knowing how to apply your photography and market it.'

Certainly Tcherevkoff had revised his own view of photography after spending a few years working for top photographers in New York. He also felt



Michel Tcherevkoff

Basketball court (*left*) *To create this arresting shot, the photographer built a miniature court and used miniature props and a lifesize pair of shoes. The picture was taken with a 20 mm lens set at f/16 and was lit with strobes*

Pyramid of steel *Tcherevkoff floated a 30 cm high pyramid over a sheet of stainless steel and took a double exposure for the stars and the beam of light. Shot on a 35 mm lens at f/16, this was taken for a steel company*

Health risk *Shot for an advert about long term pain relief. The cut-out figures were set in a metre-long rubber cast tunnel, painted red and lit with strobes and neon lights. He used a 20 mm lens set at f/22*

that he had learned enough to branch out on his own.

Although he started as a fashion photographer, Tcherevkoff soon decided that this was not his kind of photography after all and switched to still life because he did not really enjoy working with models. As he says, 'I feel good with objects. I often feel shy with people and so I can feel awkward with models. If a model comes in one day in a bad mood, or if we don't automatically get along for some reason, I will not be able to get a great shot. With still life photography I am not dependent upon any outside people. It is totally my picture from beginning to end, and I think it's terrific. I have a wonderful time.'

Obviously, the tremendous satisfaction he seems to get from his work stems partly from the unusual degree of freedom he is often given in assignments. Tcherevkoff is frequently asked to participate in the design of a particular advertising campaign—an unusual role for a photographer in this field. This is because his clients already know his highly individual style. They want the kind of pictures that only he can produce. On these occasions he works closely with the art director of the advertising agency.

At other times the brief he is given is more restricted. He may have to follow a design which he has to photograph fairly precisely. Even so, the design has been produced with Tcherevkoff's style

specifically in mind.

Naturally, he prefers to work with as much freedom as possible so that he can apply his own creative skills to the job. Nevertheless he does not mind if the subject he has to photograph is not to his liking. 'Within the context of what I do, the subject is immaterial. What counts is how I photograph it, how I play with it, the drama that I can bring to it with light or angles, and so forth. The subject could be a light bulb, a pack of cigarettes, a watch, shoes, anything. It doesn't matter.'

The amount of time he spends on individual assignments depends on their complexity, but a typical assignment is completed five days to two weeks after the client telephones him. Tcherevkoff works at a very intense pace. As soon as he has been commissioned to do a job he immediately arranges a meeting with his clients to determine exactly what is required. Two days later, he has the design for the finished shot ready. After this has been discussed he starts to prepare all the elements that are necessay to produce the final finished shot.

Men's fashions *The setting for this Pierre Cardin suit was created with specially made three-dimensional walls, a painted background and smoke from dry ice. Tcherevkoff used a 28 mm lens at f/11 and lit it with strobes*

Arctic landscape (*far right*) *The packet was encased in clear plastic and the arctic set created with wax, baking soda and shredded styrofoam. Tcherevkoff used a 35 mm lens at f/11 and lit the set with strobes*

Jet set encounter *Asked to illustrate the idea of a highly personalized approach to managing the assets of wealthy clients, Tcherevkoff built a set over 10 metres square in his studio. He personally designed the set*

Molecule in space *This model set (5 by 10 metres) was built to promote IT&T's portable telephone technology. The road is painted on a laminated surface and the model car wired with fibre optics to simulate headlights*

Michel Tcherevkoff

ARCTIC
LIGHTS

Preproduction and preparation are the most elaborate and time-consuming aspects of any job. 'The shooting is the fastest part,' he says. 'It only takes 1/1000 second!' In fact he usually spends only a day shooting, but two to three weeks preparing for the shot. This is because his success rests on his ability to make his surreal images look life-size and realistic—even though the images are from the realms of fantasy. To achieve this effect he must be a perfectionist. The way he prepares the set is one of the most important parts of his photography.

He designs all his own sets. Every detail on them has to be just right so he hires professional set designers to construct the props, make the models, and build and paint the scenery. The result is a scene that usually fits on to a tabletop not much more than a metre square. Every detail in the model is so realistic that when the photograph is printed it appears lifelike.

Many photographers are unwilling to cope with the technical problems of this sort of photography but to Tcherevkoff it all seems simple. He has a natural technical ability and an instinctive logical approach to solving such problems. The ideas of art directors and designers may often seem impossible to realize in practice—to Michel Tcherevkoff they are a challenge.

'I suppose my photography is technical in that you have to know how to use strobes, you have to have a sense of lighting, and you have to have a sense of colour and design. But it is not difficult. I don't work at it. It's natural for me.'

Everything is prepared and ready the day before the final shoot so that Tcherevkoff can go straight into his studio and work. Then he will shoot from five to ten rolls for every one of his final images. As he says, he actually only needs one roll of film but he shoots more so he can give his client a choice of lighting and exposure. Tcherevkoff feels that the most important part of his photography is to satisfy his client. He tries to take pictures that please himself, of course, but the client comes first. Realizing this has undoubtedly contributed to his present success.

'Success only comes with hard work. If I make the high fees that I make now, it is because I work very hard at my job. It is a demanding job. You've really got to give it everything you've got. There is no compromise. You can never say, "Oh, I'll do better next time." You've got to do the best job every time you shoot. Although as a photographer, you make pictures every day, these will be all the work that your client is going to commission for a while. Dedication is critical. You always have to do better. You cannot have a failure. People remember failures, they don't remember successes.'

Tcherevkoff's meticulous care with his photographs is also reflected in his attitude towards his assistants. He feels that many of the young photographers who want to be assistants have a misconception about professional photography. Although he was first attracted to the business because of the glamorous lifestyle he saw, he emphasizes that this element is only five per cent of the business. 'The rest is hard work and long hours.'

When hiring assistants, he seeks those people who are going to get as involved in the process of photography as he does. To him being an assistant is more of an apprenticeship than a job, and since emotionally, physically and mentally he becomes wholly involved in his work, he needs to have assistants who are just as motivated and just as dedicated as himself. As he says, 'Photography is not something that you do mechanically with your hands while you think about something else.'

Tcherevkoff is therefore very particular about his pictures, the people he hires, and the designs and sets that he has made. To ensure that his equipment does not let him down, he checks it meticulously, at every session—and cleans the inside of the camera each time he changes film.

He has no preferred make of camera because he feels that most major manufacturers produce equipment that is optically and technically good. All he asks is that the equipment reliably produces a sharp image. Most of the time he works in 35 mm format and prefers wide angle lenses, which add the illusion of space and depth to his subjects: he may use anything from a fisheye lens to a 300 mm telephoto, but he prefers 20 mm to 35 mm lenses.

He uses Kodachrome 25 colour slide film almost exclusively, working in black and white only if a client wants additional shots for a newspaper advertisement. He dislikes black and white photography feeling that the technique is different from colour. One example he gives is that reds and dark greens become very dark greys in black and white photography and are therefore very different elements. And he does not like working in one tonal range, preferring the flexibility of the thousands of variations in shade that colour photography provides. 'I appreciate good black and white photography but I don't enjoy it. I don't understand it or have a feel for it. I think in colour.'

Having done advertising photography since he started, Tcherevkoff is now beginning to think about changing the direction of his career towards movie films. The still image, he says, 'has started to move in my head.' His film work will also be commercial and he wants to make animated films for advertising. This will be the next phase of his career, although, as he says, he loves still photography too much to abandon it altogether.

Tcherevkoff is always playing and experimenting with photography, especially with new electronic techniques. But he never does this sort of work without an aim in mind. He always channels his creative interests into work that he does for clients. He enjoys photography most when he is approached with a new challenge. 'I don't consider it work. I come to the studio and I'm having a good time all the time. All these pictures, they're really all for me: I just happen to sell them to clients.'

Night scent
For this picture of the perfume 'Volcan d'Amour' Tcherevkoff built a set on rippled plastic, and double exposed for the moon and stars in the background. The smoke was produced by dry ice and the set was shot at f/22 with a 55 mm lens

Space structures
Tcherevkoff is best known for the surreal science fiction images that he creates. He always shoots his miniature sets with a wide angle lens to give the illusion of depth and uses a wide aperture and strobes

Michel Tcherevkoff

Simple Sabattier effects

Spectacular and quite unique pictures are possible by 'solarizing' your photographs. The technique uses normal materials and is an ideal way of converting some second rate images into worthwhile pictures

If by accident you very briefly expose a print to light during development, it is normally ruined. But before you throw the print away, examine it carefully and you will notice that fogging has a peculiar effect. Instead of simply darkening the whole print, as you might expect, the darkest areas actually become lighter. Indeed the image becomes partially negative. You can exploit this phenomenon, known as the Sabattier effect, or pseudo-solarization, to transform mundane pictures, particularly, into striking impressionist images.

Prints produced using this phenomenon are often referred to as being solarized. This is a misuse of the term, since true solarization is very difficult to achieve with modern materials (see page 754), and it is more accurate to call them Sabattier effect prints.

Although in theory you have to do very little to pseudo-solarize a print—simply fog it during development—it is not always easy to achieve satisfactory results in practice. The problem is that it is difficult to fog a print in exactly the same way every time and the balance between positive and negative can vary from print to print. One of the problems is that the effect of fogging is influenced by the duration of not only the fogging exposure but also the original print exposure. It also depends at just what stage in development the fogging exposure is made. Even the age of the developer may affect the result.

Naturally, then, producing Sabattier effect prints can be a rather hit-and-miss affair and you must be prepared to make experiments and waste a few prints before you achieve satisfactory results. Nevertheless, with practice and experience, you should be able to come to terms with the rather unpredictable nature of the technique and regularly produce good prints.

B & W Sabattier

Although the results are perhaps slightly less striking than with colour, Sabattier effects with black and white prints are simple to produce and require no extra equipment. You can buy a special print developer called 'Solarol' that is designed especially for this purpose and is supposed to enhance the Sabattier effect. Many photographers, however, believe that you can achieve equally good results by using partially exhausted print developer left sitting in a dish overnight: the accumulation of development by-products in the developer may help to control the formation of the solarized image. But you can produce perfectly acceptable Sabattier effects using normal, fresh developer.

Henry/Explorer

Trees *Choose a clearly defined, boldy shaped original for your solarization experiments. The colours may turn out unnatural but attractive*

A controllable white light source is, of course, essential for the fogging exposure and a basic enlarger is perfectly adequate for this. Simply switching on the room light during development will not do—this would probably give you just a black sheet of paper.

Any photograph can be given the Sabattier effect, but it may be better to select a fairly simple image so that the print does not become a confusing mess of light and dark. To make a Sabattier effect print, first make a normal, correctly exposed print from the selected negative and put it aside to act as a reference.

Then take a new sheet of paper and expose this in exactly the same way—as if you were going to make a second normal print. But instead of developing this second print, put the exposed paper away carefully in a light-tight envelope or drawer—keep it separate from any other paper, though, to avoid confusion.

To establish the fogging exposure, remove the negative from the enlarger so that it projects white light on to the baseboard. Switch off the enlarger and take out a small strip of unexposed printing paper. Place this strip on the enlarger baseboard and make a series of test exposures in exactly the same way you would make a test strip for a normal print (see page 164). Make the exposures in five second steps and keep a careful note of the exposure given at each step. Process the test strip normally but remove it from the developer after only half the normal time has elapsed.

Under normal room lighting, examine the test strip and work out the exposure that gives a mid grey tone. If there is no mid grey, repeat the test with adjusted exposure steps. When you have established the exposure time for the mid grey tone, make a note of it. This will be the time for the fogging exposure.

For the next stage your enlarger must be protected from water and developer. Cover the baseboard with an old towel or several thicknesses of newspaper and place a dish of water on top. Take out the exposed sheet of paper, and develop it for half the normal time. Then carefully move the print to the enlarger and slide it gently into the dish of water with the minimum of disturbance. When any ripples have died away, make the fogging exposure found by the test strip. Transfer the print back to the developer dish and complete development by developing it for half the normal development time. Complete other processing steps in the usual way until you have your final print.

If you are not satisfied with the result,

Black and white and colour solarizations

1 *Begin by making a test print of the original image. Here, a transparency is being printed on to lith film, but you can use paper, and colour or B & W*

2 *If you prefer, work directly from a strip of negatives or slides (colour or black & white). Use sponge and glass to keep film and print material flat*

3 *Develop the test print and, if you have a useful range of exposures along your strip, repeat the test and place the undeveloped print in a paper safe*

4 *Expose and then process a test print to determine which fogging exposure (plain light from the enlarger) just begins to darken the same material*

5 *Take the first print from its light tight box and develop it for about half the normal time, draining it well but avoiding streaks of uneven development*

6 *Slide this print carefully in to a white dish, containing cold water, which is placed directly beneath the lens of the enlarger, ready for re-exposure*

7 *Expose the partly developed print to plain light from the enlarger. The solarization effect on colour materials can be altered by changing filtration*

8 *Return the re-exposed print to its developer and continue for the remaining period of development, after which fogging should be clearly evident*

9 *Examine your test print to check which combination of original exposure plus the fogging exposure gives the most pleasing result, and repeat this*

Jon Bouchier

there are a number of variables that can be altered next time you make the print. The density of the negative image can be changed by altering the fogging exposure, for instance. If the print is too light overall, increase both the original and the fogging exposures. If the positive areas of the print lack contrast, reduce the original exposure and give the print more development before you make the fogging exposure.

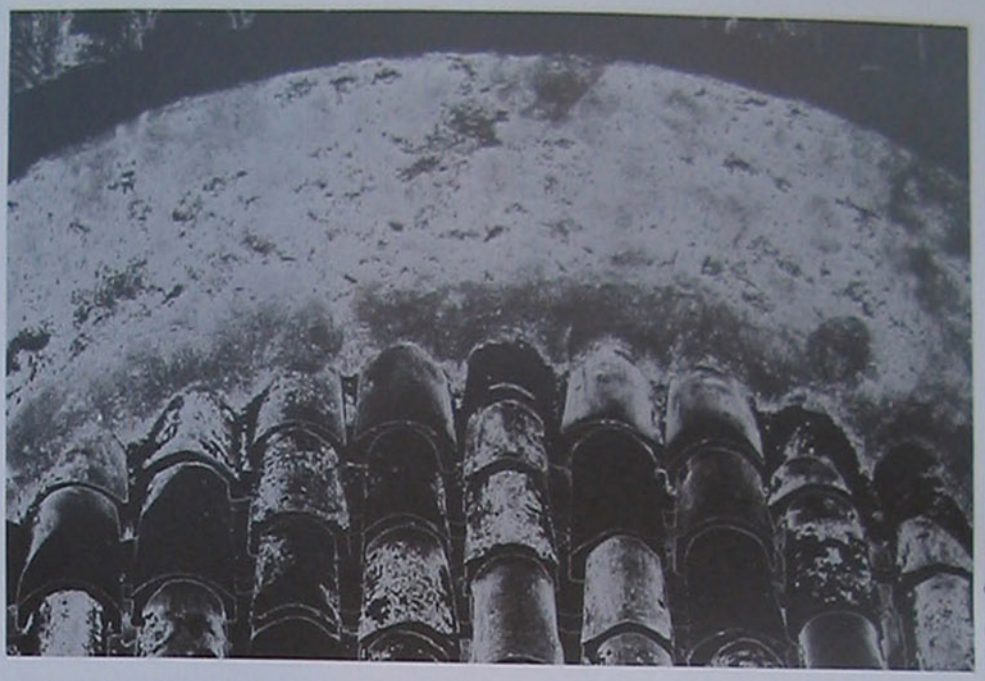
Another factor that can be adjusted is the stage in development at which the fogging exposure is given. If you make the fogging exposure close to the end of development, leaving the print in the developer for almost the full time before exposing to white light, the negative image will be very weak. If you were to re-expose at the beginning of development, the Sabattier effect would again be weak. But in between these extremes, you can adjust the stage at which fogging takes place to get the effect you want.

The problem is that even if you do achieve the right effect, it is very difficult to repeat it using this method. Prints given the Sabattier effect in this way also tend to be rathèr gloomy in appearance. If you want to make a number of identically 'solarized' prints or achieve a brighter image, you must use the more elaborate *indirect* technique.

Sabattier negatives

The indirect Sabattier effect involves fogging a film negative from which you can make any number of positive prints. A Sabattier effect negative gives prints that are predominantly light rather than dark.

You can make a Sabattier effect negative by taking the film you have exposed in your camera and exposing it to light part-way through development. However, since solarization is unpredictable, you risk ruining your valuable pictures irredeemably.



Pauline Gentry

Waterfall *This is the result of fogging the original slide film. You may find it better to work on copy slide or negative film if the originals are to be spared*

A better method is to choose a suitable black and white negative and make a film positive by contact printing on a blue sensitive film such as Kodak Fine Grain Positive type 5302 which is sold in 17 m lengths of 35 mm format. You can then contact print this positive on to another piece of type 5302 film to produce a negative that can be safely given the Sabattier effect. Type 5302 film can be handled under ordinary darkroom safelighting, so it is relatively easy to make contact prints using your enlarger as a light source (see page 250) but make sure that the film positive is properly dry before you attempt to contact print it to make the negative.

The Sabattier effect is then produced in the same way as for prints. Make a test strip and re-expose the duplicate negative in a dish of water in exactly the same way as for prints. Note that when you print a Sabattier negative, the Mackie lines (see page 754), being clear on the film, print black on the final photograph. Sometimes the line is very clear, at others it is indistinct, depending on film type, development and agitation technique.

A further refinement is to solarize both the copy negative and the intermediate positive from which it is made. Such multiple solarization effects can be repeated to give an enormous range of different if unpredictable images.

'Solarizing' in colour

Sabattier effects can be even more striking in colour than in black and white but the process is more complicated.

One problem with producing the Sabattier effect in colour prints is that it is difficult to interrupt development when you are using a colour print drum. It is therefore simpler to process colour prints in dishes. Dish processing of colour prints is not as easy as processing in a drum, is less economical and less consistent, but can be mastered with practice. Make a few normal colour prints using dish processing before you attempt to make a Sabattier effect colour print.

A second problem with colour is that processing of colour materials takes place in nearly total darkness, so it is harder to make tests to establish the ratio of printing to fogging exposure. Nevertheless, the procedure for finding the correct fogging exposure for solarization is almost the same with colour prints as with black and white. The main difference is that when you work with colour you have a choice of what colour light you use for the fogging exposure. A good choice is a colour that complements the predominant colour of your final print. For example, if you are working with the negative-positive colour print material and the picture is predominantly blue, a blue fogging exposure gives highlight areas an interesting magenta solarized appearance that can be very striking. You may have to make several attempts before you achieve a result that pleases you.

The development given to the paper

Ron Sutherland

Roof tiles *The original for this image was a colour slide. This was projected on to lith film to produce a very high contrast negative which was given a fogging exposure four times as long as its initial exposure. The solarized image which resulted (left) was contact printed on to colour paper to produce the greenish image (right)*

after the fogging exposure is too short to give really saturated colours, but this is not a disadvantage since it tends to enhance the solarized effect. If you want more saturated colours you must make the fogging exposure earlier in the development phase, but be careful: too early fogging exposure gives nothing but a dense black print.

It is possible to use similar techniques to solarize most types of reversal colour film material. Unfortunately, the process does not work very well with reversal print material and the cost may be too prohibitive for the amount of experimenting that is needed to find the best combination of development times and fogging exposures.

Combinations

If you combine black and white solarization with colour printing it is possible to achieve some very dramatic effects while maintaining complete control over the final image.

The first step is to contact print a colour negative or slide on to panchromatic black and white film. Make the contact print with the original negative or slide emulsion side up—that is, facing away from the emulsion of the copy film—so that both pieces of film can be placed in the enlarger emulsion side down when you make the final print. Fog the contact print to give the Sabattier effect in the usual way.

Next make a normal colour print from the negative or slide. This serves two purposes: it tells you what the correct filtration and exposure is, and it gives you a reference against which you can align the images from the original and the solarized copy when you make the final print. Since this process involves making two exposures on a single sheet of paper, you must have an enlarging easel that allows a sheet of paper to be removed and replaced in exactly the same position.

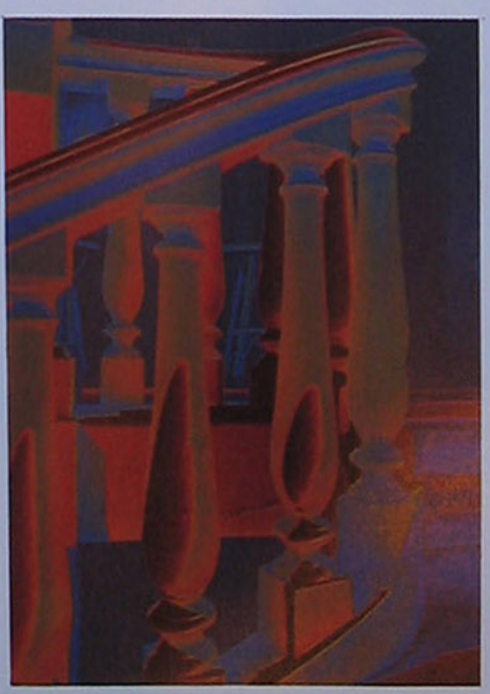
You should also make a test print on colour paper from the film contact print to find a suitable exposure and filtration (see page 859).

Make the final print by exposing the negative on to a sheet of colour paper. Put the exposed sheet in a light-tight drawer. Place the reference print in the enlarger easel to make sure that the image you have just exposed on to the sheet of colour paper is properly in register with your reference standard. Replace the negative with the solarized film contact print and align the projected image with the reference print. It is not necessary to be completely accurate when you do this—alignment by eye is quite sufficient. Replace the reference print with the sheet of exposed paper and make a second exposure. Process the print normally.

Printing this way allows you to alter variables such as colour and density over a wide range, while still retaining control over the final effect. You can use either positive–negative or reversal colour printing paper according to whether your original image is a print or a slide. The resulting prints can be uniquely effective with the right choice of subject, and can have an appearance unobtainable in any other way.

Anne Hickmott

Bannisters *A duplicate of the original image was fogged to white light*



Contact copy *By contact printing the centre image, another effect is obtained*

Colour change *A different effect was obtained by re-exposing to coloured light*

Battery power

Buying batteries for your camera and accessories may not be as straightforward as it seems—the wrong choice could damage expensive equipment while a careful choice could save you money

Recent advances in camera technology have largely been due to developments in electronics. The result has been that cameras have gradually become more and more dependent upon batteries as a source of power.

There are still some types of cameras that only need batteries for their light metering systems and can function perfectly well without them. But most modern cameras need batteries, so it is important to have the right type.

There are a number of different types of battery available. Each type has specific properties and is designed to perform a specific task. The three main ways in which batteries are used in cameras and accessories are as a power source for light meters, automatic winders and motor drives and in electronic flash units. The more your camera depends upon electronics to function, the more careful you need to be in your choice of battery.

Dave King

Power in a flash *Expendable batteries like these are a cheap and instant source of power for meters, flash units and motor drives*

Often you have no choice over which type of battery you use in your equipment. Most light meters are designed to be fitted with a specific type of battery. Using the wrong kind could severely damage your unit. For flashguns, autowinds and motor drives you may have more choice over the kind of batteries you use. Your decision must usually depend on how often you use the equipment, and on how much you want to spend on batteries.

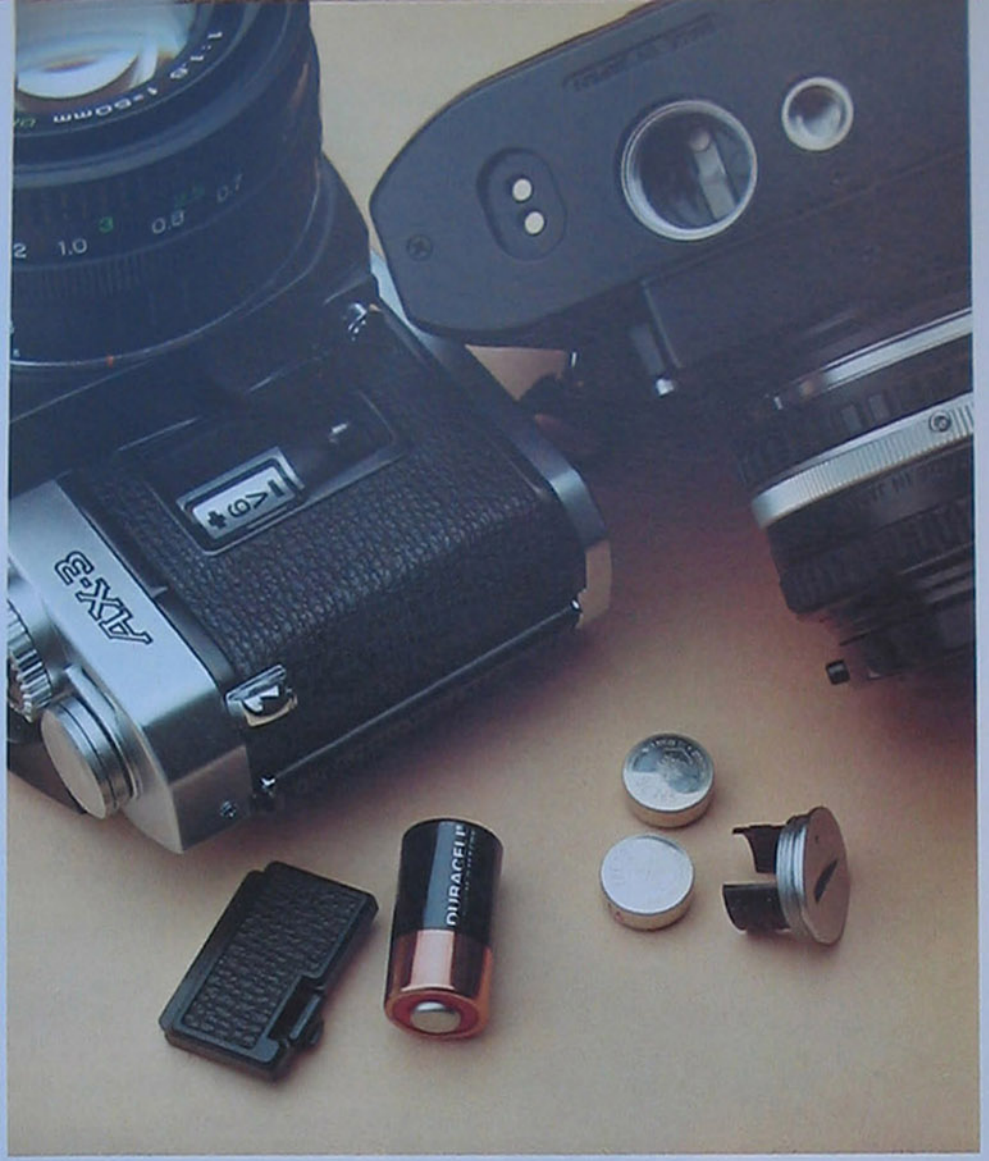
When fitting new batteries, as when handling any photographic equipment, you should always follow the manufacturer's recommendations and advice carefully. Batteries of different types are often not compatible even though they may look the same. If in any doubt, you should always check with your dealer or contact the manufacturer directly.

Batteries for meters

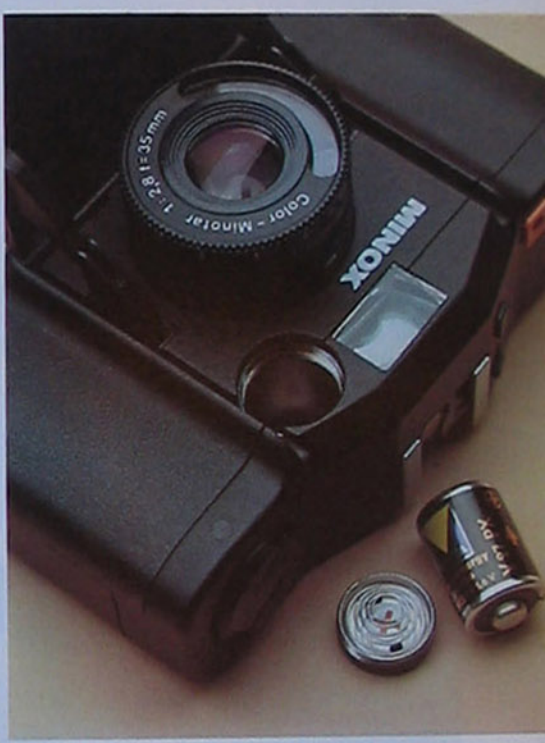
Early hand-held light meters, like the Westons, contained selenium cells. These cells require no batteries since they produce their own electrical current when light falls on them. Though some cameras, like the Olympus Trip, still use such cells, the light meters in most modern cameras are powered by batteries, and contain light sensitive cells which alter their electrical resistance according to the amount of light falling on them.

The ideal battery for use in a light meter is one which provides a very steady output throughout its life and which, when it eventually dies, does so very quickly. This way there is no danger of incorrect exposure due to low battery power during the expiry period.

The first batteries of this type were the little mercuric oxide batteries which appeared in the early 1940s. Still in production, they are small, button shaped and sealed in stainless steel, making them virtually leakproof. However, because of the environmental pollution caused by the processing and disposal of mercury, Japanese manufacturers switched to producing batteries containing silver oxide. Both types are now available, their popularity varying in accordance with the fluctuating world price of silver. They may look the same, but are not interchangeable, however, since a mercuric oxide battery has a voltage of 1.35 volts while silver oxide



Dave King/batteries courtesy of Duracell



Light meters *Most built-in light meters accept button-shaped batteries but the metering system on the Fujica AX-3 requires a cylinder-shaped battery (here, of the lithium type)*

Flashguns *can often be fitted with penlight batteries of the kind used in hand torches*

Small camera, big battery *Despite its diminutive size, the Minox 35 GL requires a large 5.6 volt battery to power its metering system*

batteries are rated at 1.5 volts.

Both mercuric oxide and silver oxide batteries have a reasonable life expectancy. They can last two years or more though it is advisable to change them about once a year. Manufacturers do not date stamp batteries and you never know how old they are when you buy them, so it is always best to use a dealer with a rapid turnover of stock since this is the only way that you can be reasonably sure of getting a new battery.

Normally, it is pointless buying two batteries at the same time—one as a spare to be fitted when the one in the camera runs out—because the life expectancy of a battery is approximately the same whether it is in the camera or on the dealer's shelf. Both will therefore expire at about the same time. On special occasions such as a holiday, it may be worth carrying a spare in case you accidentally leave the light meter on and drain the power.

In an effort to beat the fluctuations in the world price of silver, some manufacturers now produce manganese-alkaline batteries for use in built-in light meters. They are considerably cheaper than silver oxide batteries and fit most cameras designed to take the silver oxide type.

A recent development has been the application of the metal lithium to battery technology. Lithium is a very reactive metal. Like potassium, it can behave very violently if it comes into contact with water and lithium batteries have to be very well sealed to ensure that no water can seep in.

The light metering system on the Canon AE-1 can be fitted with a cylinder-shaped lithium battery which replaces the normal silver oxide type. In common with many lithium batteries it has a high voltage (6 volts) and cannot be used in most other light metering systems even if it will fit.

Lithium batteries have a great potential since the metal is in plentiful supply, does not pollute and is not as expensive as either mercury or silver, so eventually the batteries themselves will be cheaper. Lithium batteries are not rechargeable but have a shelf life of up to six years and can be used effectively at a wider range of temperatures than either mercuric or silver oxide batteries.

Always be careful when handling all batteries for light meters. Most come in sealed packs but should they be sold to you loose, make sure that neither yourself nor the person selling you the battery touches the contact points. This may reduce the life of the battery by up to half, or in extreme cases discharge it completely. However, you should always wipe the terminals with a clean cloth before fitting a battery.

Batteries for flash

Flash consumes much more electrical energy than metering systems. While mercuric or silver oxide batteries could be used to power flash units, four or

more would be needed at any one time, and they would have to be replaced frequently. Cylinder-shaped carbon–zinc batteries—the type used in torches and transistor radios—are cheap and are often used in cameras which have a built-in flash unit, but do not have a very long life.

The manganese-alkaline batteries of the kind manufactured by Duracell or Ucar are more suitable. They can withstand a heavier current drain than carbon–zinc batteries before becoming temporarily exhausted, so electronic flash units can be charged more quickly.

Manganese-alkaline batteries are more expensive than the carbon–zinc type but they last much longer. Durability usually increases in about the same proportion as cost. If you pay three times more for a manganese-alkaline battery than for a carbon–zinc one, you can expect it to last three times as long.

Most manufacturers quote a lower limit of about 72 flashes to each manganese–alkaline battery used in a small built-in flashgun. This corresponds to about two full length 35 mm films. You can always tell when new batteries are needed because the charging time increases appreciably.

The normal shelf life of a manganese-

Lead-acid batteries *are bulky and inconvenient to handle and carry. They are often housed in shoulder packs like the one in this flash unit*

Button batteries *for built-in light meters usually fit into a cavity in the base of the camera. Some cameras have a tiny housing into which the batteries are inserted. Plus or minus marks on the housing and on the batteries indicate which way they should be fitted. Inserted wrongly they could damage your equipment*

Dave King

alkaline battery is about a year. If you are storing your equipment for any length of time it is worth removing the batteries, even if they are the sealed leak-proof type, since some seepage may take place without your being aware of it.

While manganese-alkaline batteries are perfectly adequate for small flashguns, more powerful units need batteries that are rechargeable if running costs are to be reduced. Lead–acid batteries (miniature versions of those used in cars) were once universal and specialized kinds are still employed in flashguns used by professional photographers. They are contained in large packs carried over the shoulder.

Though very efficient electrically, lead–acid batteries are inconvenient. They must be kept topped up with distilled water and leak if stored upside down. Eventually, the lead plates turn to lead sulphate—the average life expectancy being about three years. Unsafe, heavy and inconvenient, lead–acid batteries have now been almost completely replaced by rechargeable nickel–cadmium (NiCd) batteries.

Although some nickel–cadmium batteries are produced in the same shape and size as expendable batteries they are not always interchangeable. They provide a lower voltage than manganese-alkaline or carbon–zinc types—1.2 volts as opposed to 1.5—but have a higher current flow. This can damage the delicate circuitry in some electronic flash units. Some very up to date flashes, such as those produced by Olympus, have built-in resistors to reduce the current from nickel–cadmium batteries and can thus be used both with these and with the expendable type.

Dave King

Battery type *Identical in shape and size, the manganese-alkaline batteries (left) will last much longer than the ordinary carbon-zinc types (right)*

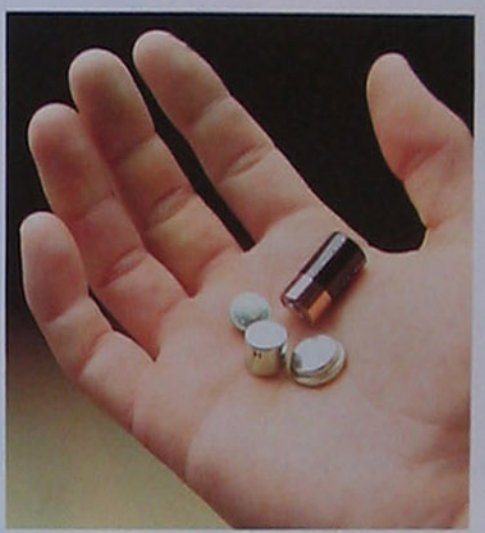
Nickel–cadmium batteries are sealed and require no maintenance at all. They should always be recharged before they go completely flat and cannot be overcharged, contrary to popular opinion. When the battery is fully charged up, it automatically reduces the current of electricity passing through it to a tiny trickle which does not damage the plates or electrolyte.

Most nickel–cadmium batteries can be recharged about 10,000 times before they begin to fail. Some have special plates which allow them to be charged very quickly, in minutes rather than in hours, however these are more expensive and fast charging should not be attempted on ordinary nickel–cadmium batteries.

Because supplies of cadmium are limited, nickel–cadmium batteries are expensive. The additional cost of the charging unit may make them completely uneconomical unless you use your flash unit frequently.

Motor drive batteries

The motors in autowinds and motor drives use more current than flashguns and considerably more than metering systems, so silver or mercuric oxide batteries are unsuitable, and manganese-alkaline or nickel–cadmium batteries are the most popular. Some motor drives, such as those made by Olympus, can use either type but others can only be used with manganese-alkaline batteries because of the higher current flow with the nickel–cadmium type. Using the wrong kind of battery in such units can result in torn films and can cause the motor to run at the wrong speed.



Battery variety *Batteries come in a variety of shapes and sizes. It is essential to fit the type recommended for your equipment*

Nikon have nickel–cadmium batteries designed specially to fit the motor-drives designed for their F2 and F3 cameras. The F2 contains two special batteries and the F3, one. Both can only be charged with a Nikon charging unit.

Electricity is very expensive when bought in the form of expendable carbon–zinc, manganese-alkaline or mercury batteries. Often electricity from batteries can cost up to 10,000 times more per unit (kilowatt–hour) than mains electricity. Lithium batteries with their extended shelf life seem to provide the best answer for light metering systems. They have yet to be applied to motor drives and flash units, which still rely on rechargeable nickel–cadmium batteries. These are fine as long as you use your flashgun or motor drive frequently and so long as neither the battery nor the charger fail too soon.

Battery tips

It is worth bearing the following points in mind when buying batteries for any part of your equipment:

When buying replacement batteries, follow the guidance of the manufacturer. Preferably take the flashgun, camera, motor drive or autowind with you, or take the old battery and make sure that the new one is identical.

Remember that batteries of the same size and shape may not be interchangeable. This particularly applies if you are replacing one type of battery with another.

Buy from a dealer with a high turnover of stock to make sure that the batteries you buy are new ones

Do not put equipment away for any length of time with expendable batteries left in place, or with rechargeable batteries left discharged

Carry a spare set of any important batteries, especially if you are travelling abroad

Never touch the contact points on a battery. Perspiration can corrode the terminals and reduce the life of the battery

Take care not to insert the battery into the unit upside down as this may damage the electronic circuitry

Assignment

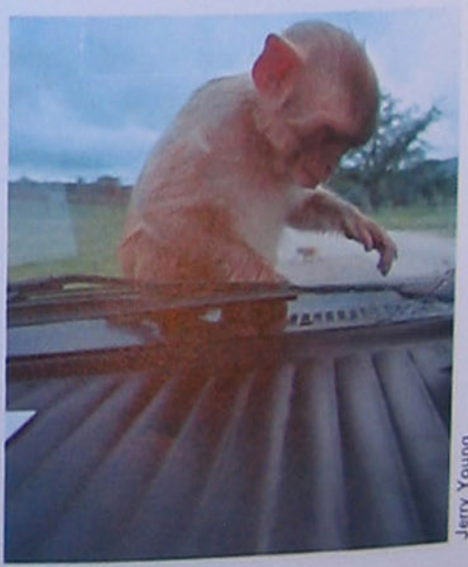
Safari park

With wide open spaces instead of iron bars or cages, a safari park is an ideal place to photograph wild animals. In some ways it is easier than the real thing

Few people have the chance to travel to Africa to photograph wild animals in their natural surroundings, but a safari park offers the next best thing. Although the surroundings often look distinctly incompatible with the animals, it is possible to close in and produce some detailed studies of lions, giraffes and other wild animals.

Jerry Young has photographed game reserves in Kenya and was surprised to find how different these were to the safari park at Longleat in the west of England. In Kenya, Jerry managed to drive right up to lions who seemed not to mind the sight of a vehicle. Giraffes and zebras, on the other hand, quickly ran away before he could get near. This situation was reversed at Longleat—the lions tended to congregate away from the road so that he could not get close, while giraffes, zebras and other animals roamed around without heeding the attentions of a photographer.

At Longleat, as in most other safari parks, visitors are warned to keep their



Jerry Young

Monkey mechanic *Jerry used his 24 mm lens to catch this monkey in the act of dismantling the car*

Lion *Using the 300 mm f/2.8 IF-ED Nikkor lens and Kodachrome enabled Jerry to get extremely sharp results*

car windows tightly closed while visiting lions, monkeys, wolves and other animals which may pose a danger. If you visit places where this precaution is not required, you should only open a car window with great care—when there are no animals nearby and when you have a companion to look out for potential dangers while you take photographs.

For this assignment Jerry often had to resort to taking photographs through the glass windows of the car. However to achieve the best results possible he

Eye to eye *A wolf became very interested in Jerry's Nikon F3 and came over to have a closer look*

John Heseltine

Camel *A 300 mm lens is very useful for photographing animals. The frame can be filled with just a head*

chose the flattest, most undistorted glass he could find—windscreens are not usually suitable for this purpose. As well as cleaning the windows thoroughly outside and inside before entering the park, Jerry also took the precaution of covering the white lettering on the front of his lenses with black tape to avoid reflections. He pointed out that for best results you should select the widest lens apertures possible and hold the lens

Pelican *Jerry waited for about twenty minutes for the bird to move and do something to make a more interesting shot.* **Giraffes** *This graceful study was the result of observing the behaviour of the animals before deciding how to photograph them*

Jerry Young

close to the glass. Another precaution is to turn off the car's engine while taking photographs to avoid camera shake.

Fearing that his 300 mm f/4.5 telephoto might be too slow to use in the darker areas of the park, Jerry hired a 300 mm f/2.8 lens. This allowed him to use slightly faster shutter speeds which froze any movement in the animals. However, since these lenses are so heavy, a monopod had to be used all the time. Telephotos used at their maximum apertures also allow the photographer to isolate the subject from the background.

Ideally Jerry wanted to spend enough time to observe the behaviour of the animals to find the best ways of photographing them. However, with only a single day to cover the whole park extensive observation proved impossible—particularly as, during a long period in the monkey enclosure, the inquisitive animals started to dismantle the car and photography had to be curtailed rather abruptly.

Legs apart *To show the animal in relation to its surroundings, a 24 mm lens was used.* **Proud lion** *This shows the sort of results that can be achieved by photographing through glass. There is only a slight loss in definition*

Jerry Young

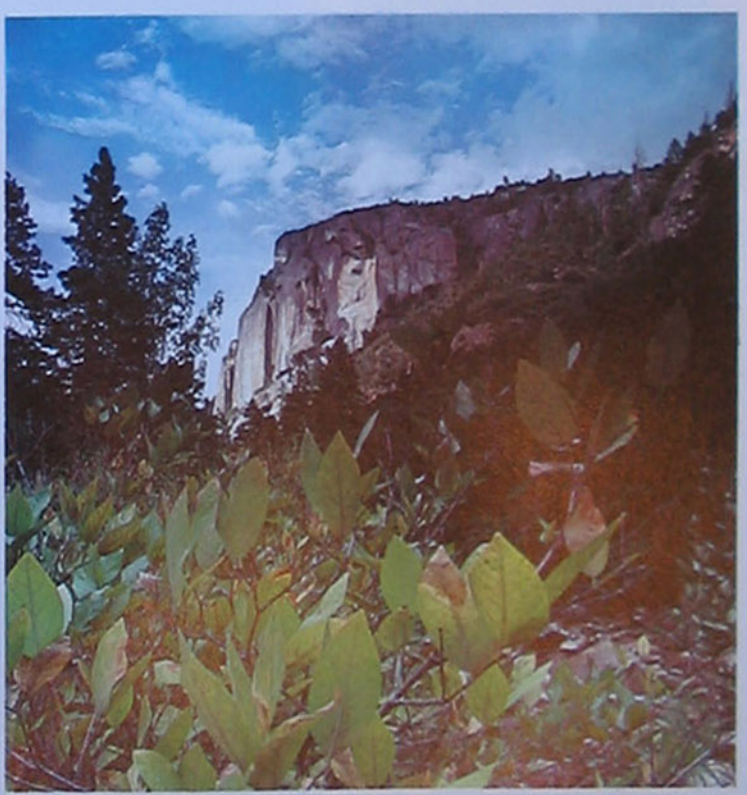
Coming in future issues of THE PHOTO

Exciting . . . original . . . creative . . . The Photo continues to bring you really useful articles on photography, both practical and beautifully illustrated. Here are just a few of the many topics that will be covered fully in future issues . . .

Abstract nude A classic Creative Approach to photographing the body. Also—composition and landscape, motor sport, water, creative colour, aircraft . . .

Behind the scenes (left) at a film studio. World of Photography reveals film making tricks. Plus—work of top photographers from Edward Weston to Terence Donovan . . .

Ships and boats And —photographing from a kite, using infrared film, posing models, photographing your TV, super close-ups, using high speed flash (lower left) . . .



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DILSTON HALL

Woods and trees

Lawrence Lawry

Woods and trees can be very rewarding subjects for the photographer, offering a wealth of material, from close-ups to a general view

To the photographer out and about with a camera, trees always seem obvious and attractive subjects. Abundant over much of the world, full of subtle colour and detail, conveniently sized and endowed with a pleasingly complete natural shape—and obligingly still when posing. They could be made for the photographer and given the right exposure any shot should be attractive. Yet results rarely live up to expectations, disappointing in both shape and colour, so for successful tree photographs, you must apply a little thought and imagination before setting up a shot.

One of the problems is that precisely because of the profusion of detail and the subtle coloration, the complex outlines of trees are often lost against anything but the plainest of backgrounds. Wherever there is any strong detail in the background, the outlines of trees become indistinct and the result is rather flat. This is not always obvious when you take the picture because, with normal stereoscopic vision, you can see the scene in depth. In a two dimensional photograph, it is not instantly clear what detail belongs to the tree in the foreground and what to the background. Other trees make particularly bad backgrounds in this respect.

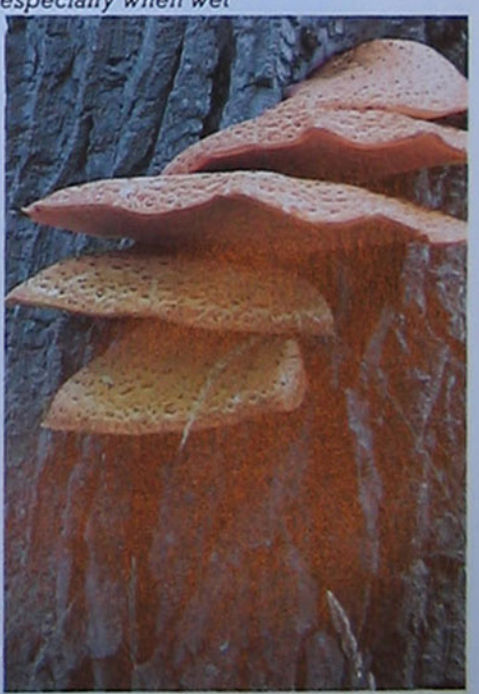
Paradoxically, then, forests and heavily wooded countryside are often the hardest places to photograph trees effectively and, if you want a clear outline, it is better to look for isolated copses in open country, or even the city. Indeed, lone trees, particularly those that are exceptionally large and elegant, often make the best photographs. But the surrounding landscape must be very simple for this type of shot to work.

Look carefully for a viewpoint that gives a clear uncluttered background, or a background so distant that its soft colour and detail do not distract. A few large trees standing in smoothly rolling grassy fields or parkland make effective shots, especially when a low angle sun casts long shadows on the grass, revealing all the gentle undulations but disguising most of the detail.

Where the landscape is too full of detail or too similar in tone to the tree you could try shooting against the sky. The general outline of the tree and even individual leaves and branches should stand out clearly against the bright pure tone of the sky. If you are shooting trees against the sky, be careful that not only

Crowning glory *Do not always look for pictures at eye level. In a thin wood, shoot directly overhead with a wide angle lens to get a spoke effect*

Fungus *In the soft light from a cloudy sky, close ups of bark texture and parasitic growth can be effective, especially when wet*



Sergio Dorantes

the topmost branches project above the horizon—unless the landscape is light in tone, the full outline of the tree is lost and the impact of the shot is reduced. To achieve a complete outline, you may have to adopt a low viewpoint even in fairly flat country, or find a tree or copse on the crest of a ridge.

An interesting approach is to work the shot so that the character of the tree and the sky match or complement each other. An old gnarled tree with withered, twisted branches could be shot against a stormy sky with swirling clouds; a light feathery tree could be pictured against a sky full of feathery cirrus clouds or against a pale sunset. Often the character of the landscape will enhance this effect because the tree is adapted to its environment.

Establishing the correct exposure for shots against the sky can be difficult because trees are generally much darker than the sky. In the photograph, either the tree is rendered too darkly or the sky is washed out. There is no easy solution to this problem and it is worth making more bracketed exposures than normal to ensure satisfactory results.

Try to avoid shooting with the sun beyond the tree, unless you want to create a silhouette. Strong sunlight from behind the camera, on the other hand, minimizes the difference in tone between the tree and the sky but may not necessarily produce the best results.

With large, full-leafed deciduous trees, strong direct sunlight washes out the colour in the leaves and gives so little shadow that the rounded form of the body of the tree is completely flattened. This kind of tree really needs oblique lighting, preferably from a fairly low angle, to give solidity of form. With more spindly trees, however, or when the branches are bare in winter, strong direct sunlight can turn the bark to an almost silvery white that looks very effective against a deep blue sky.

Perhaps the best approach, though, is to throw the tree or copse into silhouette. Again, silhouettes tend to be more effective with bare branched trees which form a dark tracery against the sky or, alternatively, if you close in on a single bough so that individual leaves are almost visible.

Remember that there is no need for the tree to fill the frame like a full length portrait. Because of its complex outline and detail, a tree can be the focus of attention even if it only occupies a small area of the frame. A popular approach is to photograph a very simple open landscape with just a single tree or a small copse on the horizon. Providing there is little detail in the foreground—it could be snow covered or simply grassy—the tree will attract the eye. Indeed, you could make an almost abstract composition by using a telephoto and the vertical format to give the picture just three elements—the plain foreground field, the middle distance tree and the sky. With few clues to depth, the appearance is almost abstract.

John Shaw/Bruce Coleman Ltd.

Nick Boyce

Autumn colours *In thin woodland, you can shoot through clumps of trees, exploiting colour contrasts between bark and leaves.* **Leaf** *Extreme close-ups take the viewer into a world in which objects appear very differently. Here backlighting shows up each tiny vein.* **Sunset** *Evening is an excellent time to photograph trees, especially against a dramatic sky—a break in the clouds helps trees to stand out clearly.* **Woods in snow** *Most trees and woods take on a completely different look each season, but especially during the winter when dark trees provide a strong contrast to the white ground*

An isolated copse in the distance, on the other hand, can provide an effective key point for atmospheric landscapes in dramatic lighting conditions.

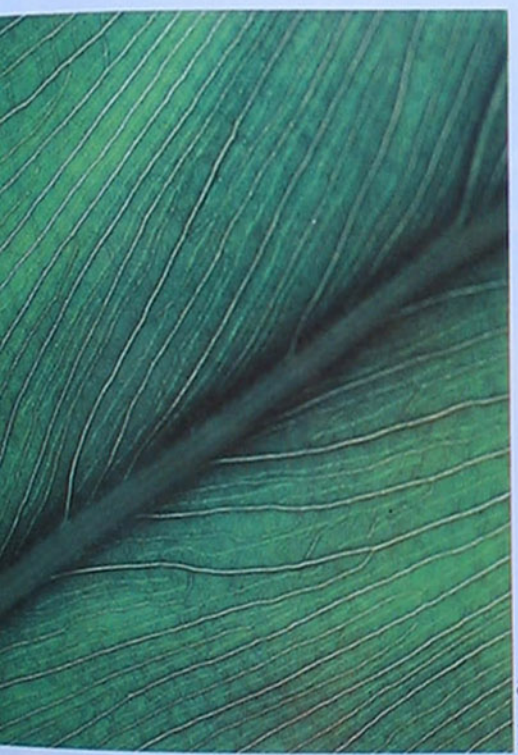
With their very distinct characteristics, trees benefit from contrasts. You can contrast green palm branches or dark branches with a blue sky, but look for contrasts between types of trees as well. In heavy coniferous woods, look for a few isolated clumps of light deciduous trees. From a distance—perhaps the other side of a valley—the big deciduous trees stand out clearly against the dark and heavy textured conifers.

Contrasts with rock surfaces or buildings may be equally effective. In cities, the organic shape and subtle colouring of trees nicely complements the angularity and harsh colours of modern buildings.

Of course, there is no need to photograph single trees or stands—although their outlines are strong and distinctive, trees offer many other photographic possibilities. An avenue of tall, elegant trees, for instance, provides a gentle, pleasing pattern if you shoot down the length of a row, capturing the repetition of the trunks. The slender trunks of young trees, shot against the light, give a similarly attractive pattern, particularly if the shot includes a few bright, almost flared highlights.

Where the trees are slender and there are few leaves on the trees—in spring or winter—there are many interesting patterns to be found if you try shooting from all kinds of unusual viewpoints. One approach that is often effective is to lie on your back and point the camera up at the crowns of the trees. With a wide angle lens fitted on the camera, the trunks of the trees seem to converge sharply towards the tops, creating a dynamic spoke-like effect. If you can, include the sun in the frame and

Robin Bath



John Sims

shoot with a narrow aperture, so that the sun's rays seem to positively burst through the trees.

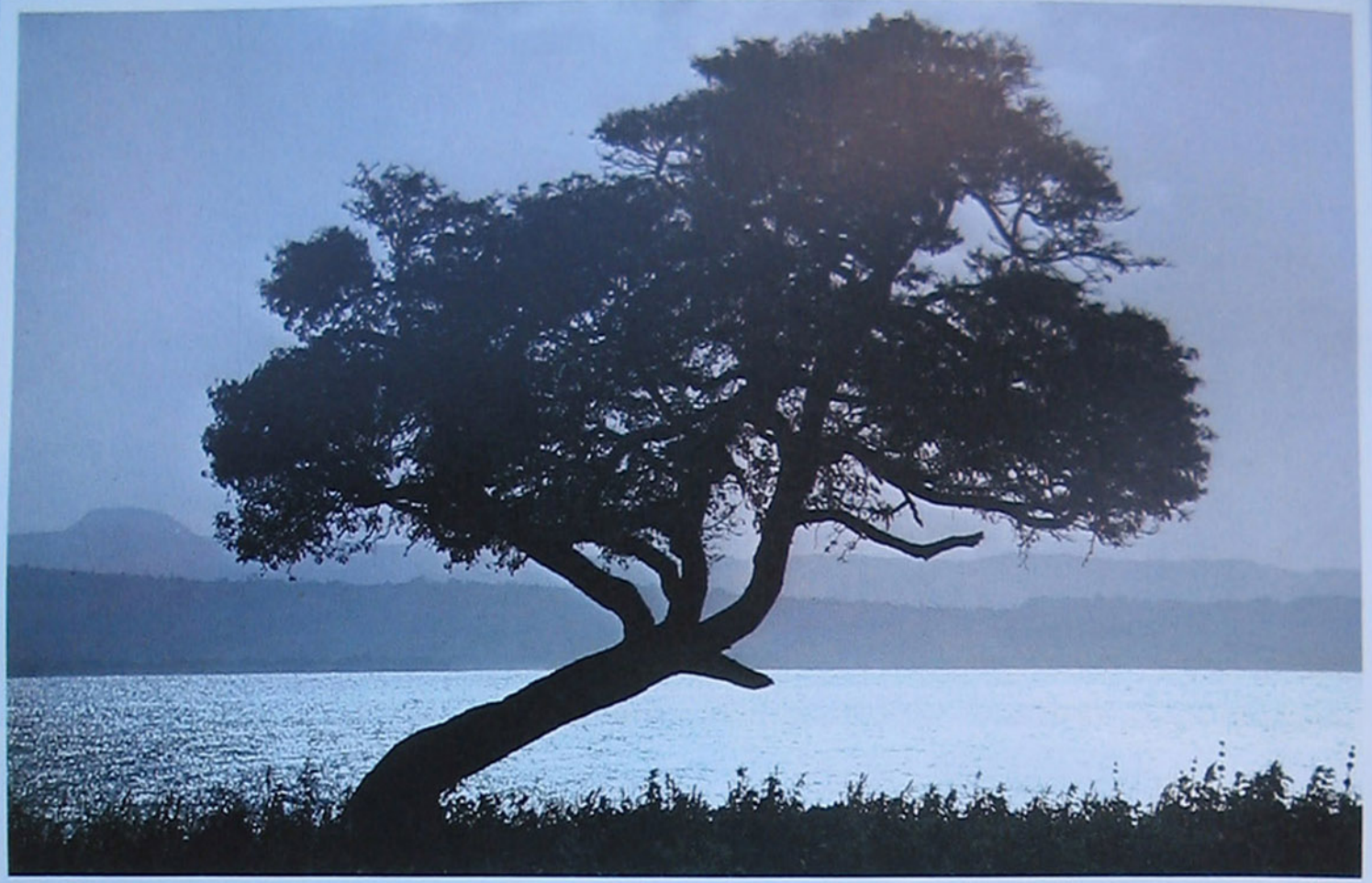
Trees respond more than most subjects to changing lighting conditions and it is worth returning to the same spot again and again to exploit the changes. In light woodland, early morning and late afternoon often give the most interesting lighting possibilities—at least when the sun is shining. Sunlight penetrates beneath the eaves of the wood at a low angle, sidelighting the trunks and picking out small areas of foliage.

When the sun is higher, light penetrates the leaf cover less easily and gives dappled, confused lighting which rarely looks as good on film as it did in reality. However, when a few shafts of sunlight pierce thick foliage, the effects can be quite dramatic. Shooting into the sun in these conditions produces dark shadows and brilliant highlights.

Of course lighting effects vary from wood to wood and from season to season. In winter in deciduous woodland, the trees are bare and there is less to stop the light reaching the woodland floor. This, then, is often the best time to make close-up studies, particularly when you have a clear view of a single leaf, exposed root or interesting bark texture. A layer of frost can make even the dullest leaf stand out and sparkle, especially when backlit.

In deciduous woodlands, each season has its own interest. New growth in spring, rich foliage in summer, strong colours in autumn and a more open view in winter. If you have easy access to a forest or wood you can chart the passage of the seasons by photographing the same scene from the same position at different times of the year.

With such an abundance to photograph, and conditions that change noticeably in appearance, woods are ideal locations for working on one of the most interesting of all photographic projects—a picture essay. Instead of concentrating on individual images, you can construct, over a period of time, a variety of photographs around a central theme.



Adam Woolfitt/Susan Griggs Agency

Sergio Dorantes

Colin Molyneux

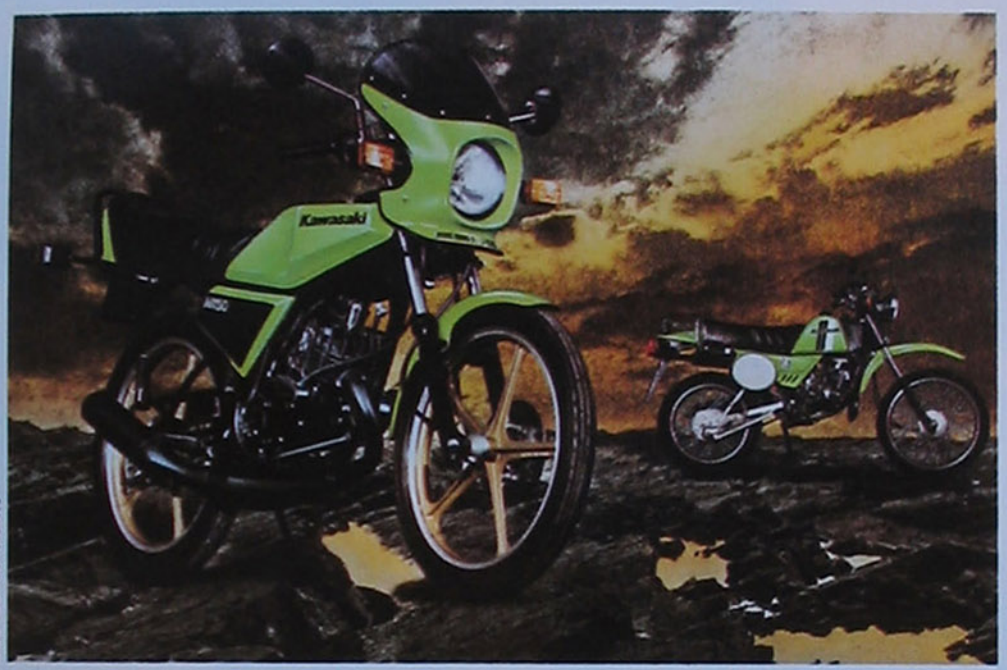
John Sims

Silhouette *If a tree has an unusual or interesting shape, you could wait for the right conditions for a silhouette. In this shot strange colouring suits the gnarled, twisted outline.* **Tree and building** *In the city, look for the contrasts between trees and buildings in shape, colour and texture. Here the photographer has used a telephoto lens to draw tree and building closer together, framing tightly so that the most interesting part of the tree is seen without any distractions from the street.* **Tree and sheep** *An almost perfectly symmetrical composition suits a tree which has a similarly symmetrical design, while a careful composition balances horizon and sky in a clean line.* **Fallen leaves** *In autumn, leaves on the ground can make attractive pictures, particularly early in the season. But move around and choose your viewpoint to include a few leaves of contrasting colours—or even arrange the leaves yourself.* **Early morning mist** *In fairly open rolling countryside, isolated clumps of trees can make effective shots, particularly early in the day when the low angle sun picks out the small undulations in the ground and mist softens outlines and obscures backgrounds. Remember to use texture lines such as furrows or tracks to lead the eye towards the subject*

John Sims

Colouring prints by hand

You can exercise your artistic flair and create some stunningly effective pictures by hand colouring your black and white photographs



Bob Carlos Clarke

Bikes *Hand colouring enables you to highlight areas with spectacular colour yet subdue other parts of a picture*

By hand colouring black and white prints you can create unique and distinctive pictures that fully express a personal, visual style. The procedure is straightforward—you apply dye or paint to a suitable print, using simple tools and working by normal light. The effects may be vivid or subtle, real or fantastic—much depends on your choice of pictorial subject and materials.

Hand colouring is not a substitute for colour printing, since the results are entirely different to those produced by ordinary colour printing. Nor should it be confused with retouching, which is usually done to correct mistakes or processing faults. Although many of the techniques of hand colouring are similar to those of retouching, the aim of hand colouring is to create an entirely new image based on a black and white original.

Choosing a print

The first requirement is a suitable print. Almost any black and white photograph can be hand coloured, but the subject matter and the way the image has been reproduced may affect your choice of materials. For example, it is usually easier to produce bright, vivid colours if you work with dyes, rather than oils, on fibre based papers. On the other hand, oil based colours make it easier to produce soft moody effects.

The best prints for hand colouring are generally rather flat and light, since dark tones tend to overwhelm the colours you apply. This is not an inflexible rule, though. For example, a dark, contrasty print with a few brilliantly hand coloured highlights could be very effective with the right choice of subject.

For some hand coloured prints it is best to start with a sepia toned original (see page 710). Sepia toning gives you a softer and slightly more natural image tone to work on than the cold blacks and greys of a normal bromide print. This can be particularly effective if your picture includes skin tones. Alternatively, you could use a print made on a chlorobromide paper such as Agfa Portriga, which also has a warm tone. You can also experiment with other types of toner that give different colours—the choice depends on your subject and your own tastes.

Paper choice is important. Although it is possible to colour both resin coated and fibre based papers, the best results usually come from fibre based prints. Resin coated paper tends to absorb water based dyes poorly, and oil based colours can only be used on fibre based paper. Matt or semi matt surface papers are easiest to work with, as large areas of colour 'take' more easily—they are absorbed into the paper with less blotchiness.

Colouring materials and tools

There are two main kinds of colouring materials—water based and oil based. Water based colours include dyes, water colours and coloured inks. Oil based colours include artists oils, special photographic oils, and oil crayons. Dyes and inks are generally sold in bottles, either singly or in sets. Water colours and oils are most conveniently bought in sets, and are packaged in tubes. Oil crayons are soft, slightly oily sticks. Most of these materials can be bought at artists' suppliers. Photographic wetting agent, which can help water based colours flow on more evenly, is essential if you are attempting to colour resin coated prints.

Oil based colours have certain advantages for some photographs. Photographic oil colour can be easier to work with than water based colour, gives softer effects, and allows you to correct mistakes more easily. However, there is a tendency for the colours to spread out over the print when you even out the tones on large areas, so oils are generally more suitable for pictures with soft outlines and broad masses of tone rather than those which demand finely detailed colour work. You can use artists oils to colour prints, but they need to be well diluted with a suitable medium and they do not have the same translucence as photographic oils.

Many other materials can be used to colour prints. Only experiment will tell you whether or not a particular paint or dye works on your pictures. Many types of food dye, for example, can be used successfully.

To be on the safe side, though, you should make your first experiments with colours sold specifically for photographic use. Most paints and inks take their colour from suspended particles of pigment. These fine particles—and the gum used to bind them to the paper—may remain visible on the surface of the print. If you find this objectionable, then you should use dyes which are completely soluble and are absorbed into the print emulsion. A further advantage of photographic retouching dyes is that they are reproduced on film just as they are seen by the eye. This is useful if you want to make exact copies of a hand coloured print.

Cotton wool swabs and artists' paint brushes are usually used to apply colour to a print. The best sable brushes are expensive, but last well if looked after. But if you only intend to hand colour prints infrequently it is far more economical to buy camel, squirrel or ox

hair types. Always clean your brushes thoroughly after use, form the hairs into their working shape, then lie them flat and leave them to dry in the air. A range of sizes from a very fine 00 (which can also be used for print spotting) up to a size 6 should cover most of your needs. Choose softer hair brushes for water based colour work and stiffer types for oil work.

Cotton wool, absorbant paper, masking tape, a water jar and some old saucers to use as palettes will also be needed.

You should work in good light on a large surface such as a plastic or glass covered table. Daylight is best for judging colours. Try out your colours first on a spare print of the one you intend working on.

Using water based colour

For your first experiments with hand colouring it is probably easiest to use photographic retouching dyes. The principles for using dyes, though, are very similar for all water based mediums.

If large areas of the print are to be coloured, soak it first in water. This will allow the dye to spread evenly and soak well into the paper. If you only wish to colour small areas of a print you need not soak it first. When the print is thoroughly wet, remove it from the water and sponge or squeegee any surface droplets off the print. To prevent the print from curling as it dries, and to hold it in place while you work, tape the edges of the print down to your work surfaces. Use masking tape or gummed paper tape.

It is best to work with very dilute dyes and build up layers of colour gradually. If your colour is too strong, there is more chance of producing a blotchy result. Add concentrated dye drop by drop to a small quantity of water in a saucer until you have a weak dye solution.

Colour large areas first using cotton wool swabs dipped in the dye solution. Go over the area with repeated applications of dye until the colour is as strong as you want it. Work quickly so that the print does not dry out before you have completed the large even toned areas such as the sky. This is more likely to happen if you use RC paper, since only a small amount of water is absorbed by the emulsion layer of the print. With fibre based paper, the absorbant base material acts as a reservoir and keeps the print damp. Use a gentle circular rubbing motion. Colours can be given subtle gradation by adding a touch of a darker colour dye to subsequent applications. A slightly darker blue can be applied to the upper part of a sky, for instance.

If you need to cover two adjacent areas of even tone with different colours,

Mari Mahr

Woodland puddle *A small patch of blue offsets the subtle colours used to enhance this picture*

Girl in helmet *Even conventional colour photography cannot match the subtlety of hand applied colours*

James Wedge

Toning and colouring procedures

1 To hand colour a print, you need colour paint or dyes—special photo dyes are best—a few brushes, some blotting paper and a sponge

2 Soak a fibre based print in water before commencing large scale hand colouring. Small pinpoints of colour may be added to a dry print

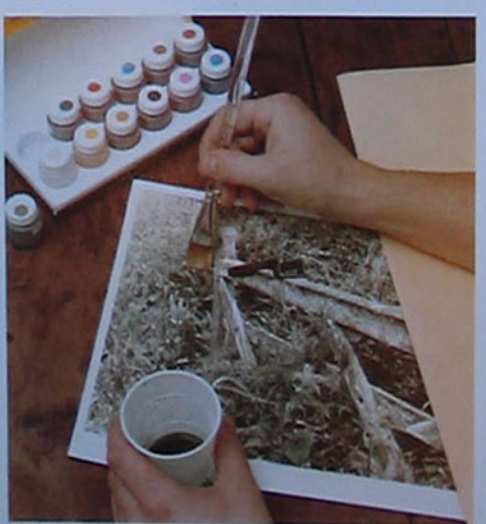
3 A sepia toned print gives a softer and more natural image to work on. Start by bleaching the print in the solution provided with the toner

4 When the image has bleached as far as it will go, wash the print thoroughly, then swab it with toner (hydrogen sulphide) to restore the image

5 If you need to cover adjacent areas with different colours, or wish to protect areas from accidental colouring, apply masking lacquer to the dry print

6 After soaking the print for at least five minutes, dry it carefully between folds of absorbent paper, so it remains damp to the touch

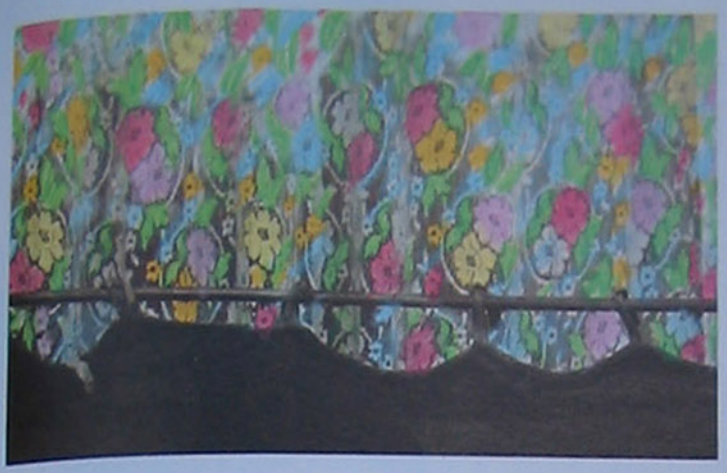
7 Try out the colours you intend using on a spare print—a test print is ideal for this. Strong colours should be diluted before use



8 Carefully work over the larger areas you intend colouring, using successive 'washes' of dilute colour to build up colour strength gradually

9 Localized colour is applied using fine brushes. Brush off each colour to check colour match. Protect coloured areas with absorbent paper

Jon Bouchier



Mari Hahr

Mari Hahr

Fabric *Spots of intense colour accentuate the design of the fabric in this picture.*
Vase of flowers *You can use a printed image as a base to create a kind of 'painting'*

you may have problems with the colours bleeding into each other where they meet. One way to solve this problem is to mask off areas of the print with rubber-based masking lacquer (available from art suppliers), or water-diluted latex based glue that can be peeled off the print after use. After you have coloured one area, allow the print to dry and then cover the coloured area with masking lacquer. The print can then be resoaked without any risk of the dye washing out or spreading, and you can set to work on the rest of the image.

Once you have coloured all the larger areas of the print, you can work on the fine details. Use brushes for these small parts of the image.

You should work slowly and carefully to obtain the best effect. As you gain experience with the technique, you can expect to take more, rather than less time to complete a print. If you should make a mistake while colouring a print, you may be able to rescue the print by giving it a long soak in running water to remove most of the dye. Do not expect this to work every time, though; it is better to regard the dyes that you paint on to your prints as permanent. As another precaution against errors, and as a matter of good style, you should try to start with the paler colours and work up to the more intense bright colours. This gives you more control and makes it easier to visualize the finished effect.

Because dye can be difficult to remove from your skin, you should wear gloves when you colour prints, particularly if you apply the colour with hand-held cotton wool swabs.

Using oil based colour

As with water based colours, it is possible to use a variety of types of oil colours, but the best results are usually given by using colours specially made for tinting photographs. These are more translucent than ordinary oil paints and have a consistency that makes them more suitable for applying to photographs.

Oils are usually applied thinly, like a stain on the surface of the print, rather than in built up layers like a conventional painting.

Ideally, prints to be coloured with oils should be properly mounted before you begin work to prevent curling or damage to the edges and corners. However, it is usually sufficient simply to tape the print to your work surface. Prints should not be dampened before you apply the colour.

Mix small quantities of the required colour on your palette, adding a little turpentine if you need to thin the paint down. The colour can be applied to large areas with either brushes or cotton wool. The special virtue of oil based colour is that it can be pushed around the surface of fibre based prints to even out tones. This is not possible with water based colours, which tend to be absorbed into the print emulsion as soon as they are applied. If you apply colour unevenly, you can spread it around by rubbing with a piece of cotton wool, or even your finger, until the tones are evenly distributed. You can blend different colours together on the surface of the print with the same technique. If this soft effect is not wanted, then you must allow each area of colour to dry before applying colour to an adjacent area. When thinly applied, photo oils do not take as long to dry as conventionally applied artists oils, but the drying process takes long enough to make colouring of sharp edged adjacent details a relatively lengthy procedure.

A particular advantage of oil-based colour is that mistakes can usually be removed with a piece of cotton wool dipped in turpentine.

Some oil based crayons and pastels can also be used for colouring photographs. The pastels are simply applied to a dry print, and then blended in afterwards using a pad of cotton wool moistened with a mixture of thinner and oil medium.

If you wish to combine water based dyes and oil based colours, you should start by applying the dyes to a wet print. When the print is dry, you can move on to applying the oil based colours. Tiny pin-points of colour, whatever the medium, should be applied last of all.

The basic techniques of hand colouring photographs allow you to produce truly individual pictures that reflect your own taste and pictorial style. More advanced techniques, such as air brushing, are dealt with in a later article.

Sue Wilks

Portrait *Hand coloured black and white prints are well suited to subjects like portraiture where a particular period effect is required*

Understanding...

Early processes

The ease with which photographs can be made today is generally taken for granted. But in the last century producing a photograph was not so simple

Photography is not a new phenomenon. The details of the two main early processes were announced in 1839, but proper photographs were being taken well before that date, and the origins of photography go back even further. But although the photographs produced during the last century look very different to those produced today, many of the underlying principles are the same.

The earliest photographs were taken by Joseph Nicéphore Niépce, who in 1822 invented a process using the light sensitive properties of bitumen. This process produced a direct positive image, usually on pewter plates, though glass, zinc and other bases were used. The process was often used to make printing plates by etching the plate with weak acid (a process known as *heliography*).

But for straight photographs the results were too crude and Niépce turned his attention to the light sensitivity of silver salts, which formed the basis of all later processes including those used today. Unlike bitumen, which is naturally sensitive to light, the later processes needed a sensitizing step. And it is this along with the different kinds of base used, which form the major differences between the processes.

The daguerreotype

In 1829 Niépce went into partnership with Louis Jacques Mandé Daguerre to produce one of the most famous of the early processes —the *daguerreotype*. This is also a 'direct positive' image, and uses a copper plate coated with a thin, highly polished layer of pure silver. To prepare the plate, it was exposed to iodine vapour in a closed box. The highly reactive iodine combined with the silver to form a thin yellow layer of silver iodide (a light sensitive silver salt).

courtesy of the Kodak Museum, Harrow

Portrait *The shadows in this dageurreotype are formed by making the shiny silver image reflect a dark surface*

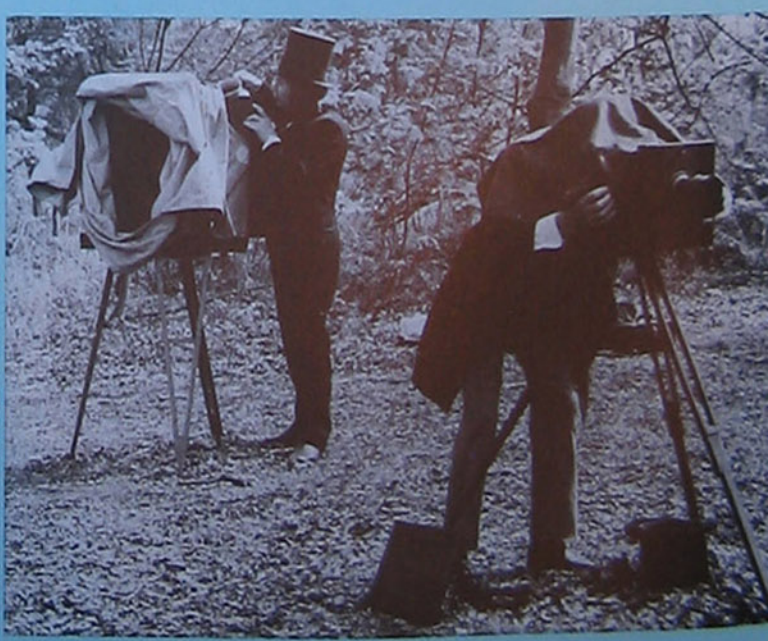
Bulky equipment *The reconstruction below shows the equipment needed for the wet collodion process, including the camera (right) and the dark tent used for sensitizing and processing the plates*

The plate was then exposed in the camera for times of up to 20 or 30 minutes, depending on the light and on the method of preparation.

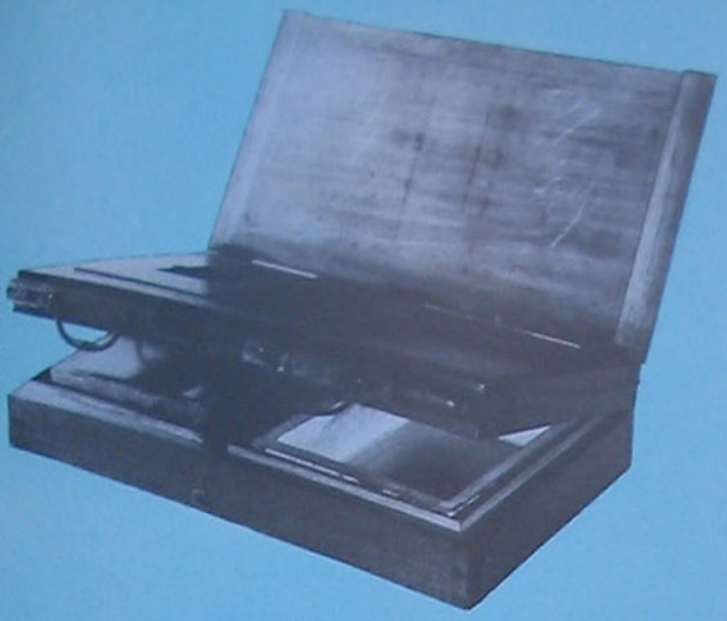
After exposure, a very faint image of metallic silver was visible, similar to the 'printed out' image that appears if you leave bromide paper in the light. This image was strengthened by exposing it to mercury vapour in a closed container, the mercury being heated in a porcelain dish with a spirit lamp. The mercury condensed on the silver iodide in proportion to the exposure it had received, the mercury and the silver of the image combining to give a smooth white finish.

The negative image could be seen as a positive if the daguerreotype was suitably lit and held so that the polished silver base reflected a dark surface, making it look black. The image was fixed using a solution of common salt, and later hypo, and then washed in distilled water.

One problem with the daguerreotype was its limited spectral sensitivity. Silver iodide is sensitive only to the shortest wavelengths of the spectrum—ultraviolet, violet and, less so, to blue. In early daguerreotypes, blue objects were reproduced light in tone while all other colours were dark or even black. Silver iodide also has low sensitivity to light, resulting in long exposure times. So to improve the process extra steps were introduced into the sensitizing process. The plate was exposed first to iodine vapour, then to bromine vapour, and finally again to iodine. This process produced iodobromide which is more sensitive, allowing exposure times of a few seconds under favourable conditions, and extended the spectral sensitivity, though some colours such as yellows, oranges and reds were still rendered too dark in tone.



courtesy of the Kodak Museum, Harrow



courtesy of the Kodak Museum, Harrow

Sensitizing box *This was used to sensitize dageurreotype plates by exposing them to iodine vapour in one part of the box and bromine vapour in the other*

The calotype

There was also another problem with the daguerreotype which was that each picture was unique and could not be reproduced. Fortunately, at the same time that the original daguerreotype process was announced, another process was made public which used a negative, allowing numerous prints to be made from one picture. This was the *calotype* invented by Fox Talbot (see pages 215 to 219).

This process used high quality paper as the base. This was brushed over with a dilute solution of silver nitrate, and when the sheet was nearly dry it was soaked in a solution of potassium iodide. This formed silver iodide on the paper, which was then washed over with gallic acid and dried.

The paper could then be stored in the dark until needed. Just before use, it was brushed over with silver nitrate and exposed in the camera slightly damp. Exposure times ranged from several seconds to five minutes because of the low sensitivity of silver iodide. The image was made visible by developing the paper in a solution of gallic acid and silver nitrate. The image, which was not visible before development, and so was a *latent* image, was reduced to metallic silver by the action of the developer, in a similar way to modern development. This was *chemical* development by a solution rather than the physical development of the daguerreotype.

As the paper was still sensitive to light after development, the image had to be fixed in hypo or a solution of potassium bromide. After processing, the negatives were waxed or oiled to make them translucent so that they could be printed easily.

Contact prints could then be made on sensitized paper similar to that used in the camera, though some other types of light sensitive paper were also used.

The main problem with the calotype process was that the fibre of the paper negative tended to show up in the print as an effect similar to graininess. The resolution was far below that of the daguerreotype, which could show very fine detail. However, the obvious advantages of the negative–positive process meant that it was this technique which was developed further.

Wet collodion

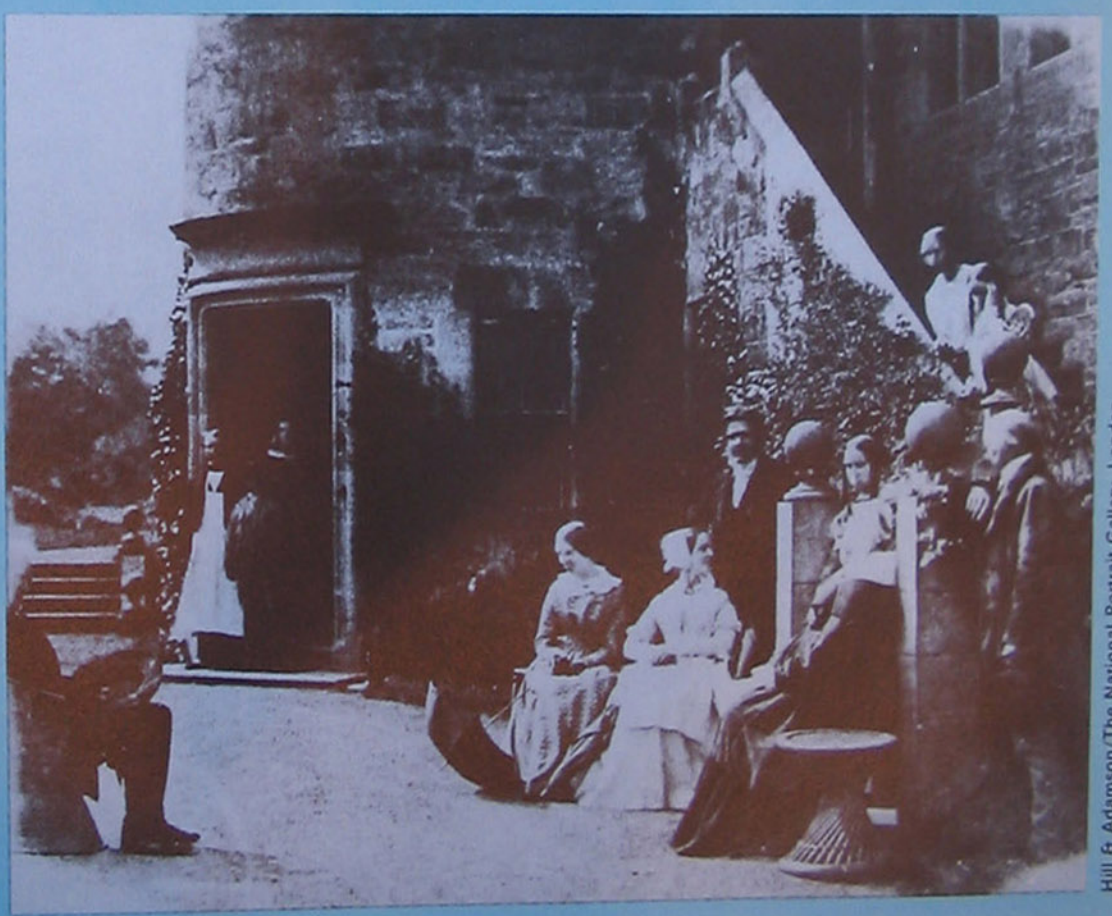
In 1851, Frederick Scott Archer published the details of the *wet collodion* process, which produced a negative on a glass support. Glass sheets were coated with a thin layer of collodion containing various iodides such as those of cadmium and potassium. The collodion was simply a binding agent, being used in much the same way as gelatin is used today. When this layer dried, leaving the collodion as a thin, tough layer, the glass was immersed briefly in a bath containing silver nitrate and a small quantity of potassium iodide to sensitize the plate.

The plate was exposed as soon as it came out of this bath, as it had to be wet during exposure and until development (hence the name). If the plate was allowed to dry, the result was a very large loss of sensitivity. Even under proper conditions, a wet collodion plate had a speed of only about 0.2 ASA (ISO), though the speed could be increased by using iodobromide.

The exposed plate was developed in a ferrous sulphate developer, but the negative was usually so thin that it normally had to be *intensified*—that is, treated to make it denser, using a solution which deposited metallic silver on the silver in the image. After fixing (often with potassium cyanide), washing and drying, the negative was varnished, as unprotected collodion deteriorates in time.

The wet collodion process was used in graphic reproduction processes until recently, and in some parts of the world is still used for making line and halftone negatives.

The calotype process *The apparent 'graininess' of calotypes like this one was due to the fact that they used paper negatives from which the prints were made*



Hill & Adamson/The National Portrait Gallery, London

World of photography

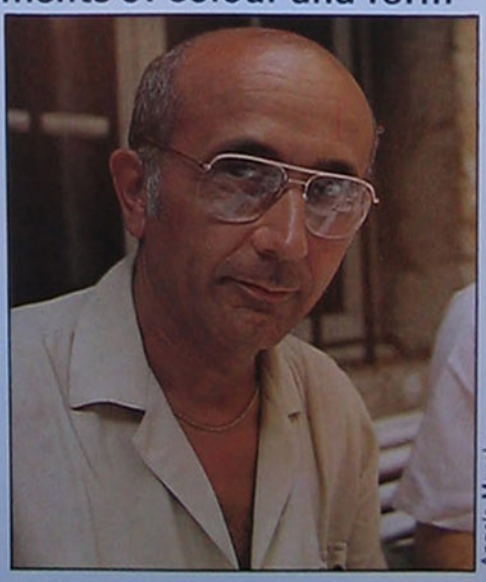
Franco Fontana

With a fresh and original approach to the photography of urban and rural landscape, Franco Fontana has revealed elements that are usually never noticed—the pure and often abstract elements of colour and form

Franco Fontana is an unusual figure in the world of photography—a professional art photographer. Rather than working on commission and contriving pictures to illustrate an article or sell a product, his pictures are intended as works of art and he earns his living largely by producing superb prints for sale and publishing books of his work.

Fontana's speciality is landscapes, but his approach is so extraordinary that they hardly seem to be landscapes. By careful framing and choice of location, he manages to achieve a remarkable simplicity in his pictures, particularly in his rural landscapes. All distracting detail is carefully excluded from the frame and the landscape is reduced to almost pure colour and form.

His urban landscapes contain a few more recognizable elements such as cars and street lamps and in his more recent work, a human element often appears, seeming to creep almost unnoticed into the frame—all that is seen of the people is a hand or foot at the edge of the frame or a lingering shadow. But even these urban landscapes bear Fontana's distinctive simplicity of style and show his primary concern for the elements of colour line and form.



Angela Murphy

It is this distinct personal style that Fontana feels is the most important element in his success as a photographer. When he first started taking pictures in 1961—while he was still a businessman in his home town of Modena in Italy—he concentrated on the kind of pictures that many amateurs love to take—romantic, attractive pictures of sunsets and fountains against the sunlight.

'I was like a child with the camera,

Rural landscapes *Fontana's early work with its broad sweeping bands of colour caught the fundamental forms of nature and introduced a completely new way of looking at landscapes, producing remarkably simple and pure images*

fascinated by the impact of beautiful scenes. I did nothing but reproduce the situation as it was.'

Fontana soon realized that it was not enough to simply photograph beautiful scenery—something anyone can do—he had to offer his own interpretation and develop his own personal approach.

He began to look at and think about the landscape in a new way and, over the next few years, the distinctive style that made his name began to emerge. By the late 1960s he had built up a sufficiently large body of work to hold an exhibition at his local art gallery in Modena, in 1968, and a couple of years later at the Diaframma photographic gallery in Milan.

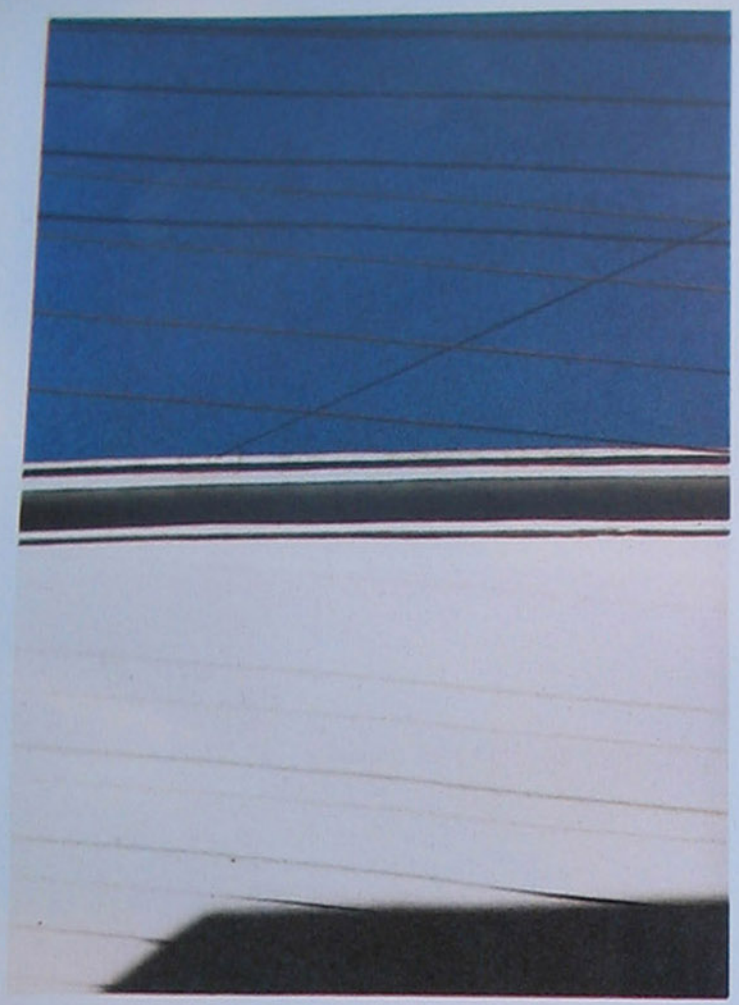
Fontana went on to publish several books of his photography, including a portrait of his home town *Modena una citta* (1971) and a book of rural landscapes *Terra da leggere* (1974). In 1976 the University of Parma published a treatise on his work.

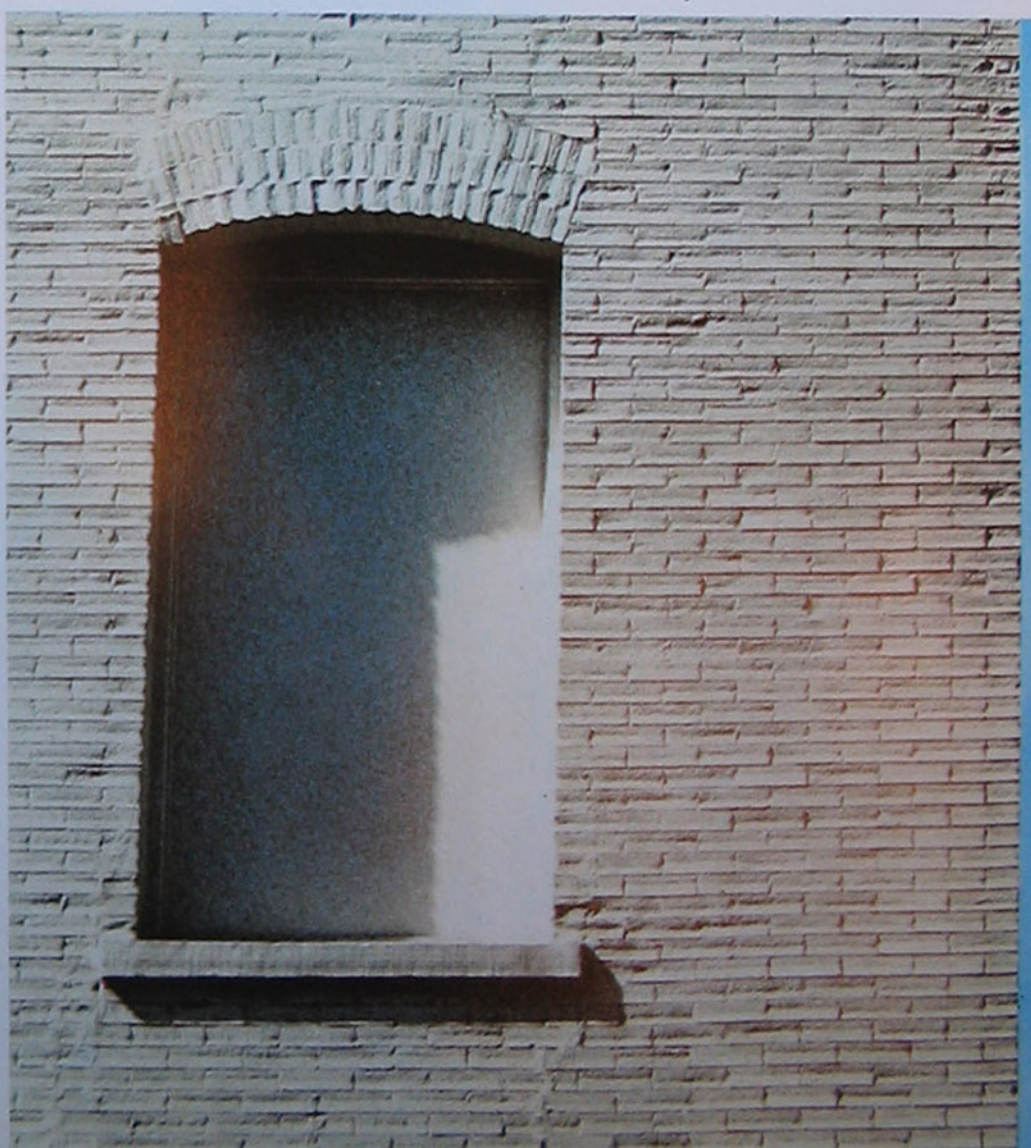
His work attracted a growing reputation and he felt increasingly that his business life and his photography were incompatible. 'I took stock of my situation and decided I couldn't do different things. Fragmentation is not ideal for creativity.' So, at the age of 43, he decided to give up his business life and concentrate on photography full time.

Since then Fontana's work has become increasingly well-known, although he was not internationally recognized until well into the 1970s. As he says, 'In America the facilities for a photographer are such that when someone does something creative he is encouraged in his work. When an Italian does something he has to struggle to make himself known. There is no institution, especially for photography, to help him.' Nowadays, however, he is an accepted master at his art with work in most of the world's major photographic collections.

Because they contain so little instantly recognizable detail, Fontana's pictures are often likened to abstract paintings but he dislikes this description. 'My photography is an interpretation of a given situation, but it isn't abstract because what you see is what was in front of the lens. I haven't intervened in

Franco Fontana





Urban landscapes *In the late 1970s, Fontana started to apply his way of seeing landscape to the urban scene. These scenes are as far apart as Italy and Canada, but are all shown as uniform urban abstractions*

any way except to compose the picture.'

'I try to show landscapes in their essence—their roots, their primitive forms—outside time and space. Some of my pictures could have been taken 5,000 years ago or the day after tomorrow. Perhaps it's abstract in the sense that it's abstracted from all extraneous or human influences which place the photograph in time. They have no scale or dimensions.'

The success of Fontana's distinctive style owes much to his remarkable talent for selecting subjects, but the special quality is always enhanced by the peculiar vividness of the colours in the photograph. Although he never uses filters or special tricks to enhance the colour artificially, the vividness undoubtedly stems from his particular photographic technique.

Working almost exclusively with slide film, he always underexposes to achieve better colour saturation. Because the sky is so bright in comparison to the rest of the scene, it is frequently overexposed in photographs and appears washed out. Fontana concentrates on getting the sky properly exposed for saturated colours. He will, for example, underexpose by one stop, so that the sky becomes about

30 per cent more saturated while other colours may only become five per cent more saturated. The effect is that the colour saturation in the sky is increased far more than in the rest of the scene so the colour contrast is higher. 'I always expose for the part of the landscape which contrasts with the sky. I'll give a standard exposure to that part or, if it's brighter, I might underexpose it very slightly. Either way the sky will be more saturated. The amount I underexpose isn't fixed. It depends on the situation. In other situations underexposure may be fatal or useless, because the scene looks fine as it is.'

Fontana also takes six or seven shots of a scene—partly to make sure he has several copies of a favourite image, and partly so that he can bracket his exposures. Like many photographers he is never completely confident that different batches of film will react the same way.

When he has the picture that he wants, he makes a large internegative (10 × 12 cm or 6 × 9 cm) from the slide. 'When I make the internegative from which I print I regulate the colours to suit my requirements.' Contact positives are then made from the internegatives by a local laboratory—always the same lab since they are used to working with him and can produce exactly the required effect in the final picture.

Unseen presences *Fontana begins to introduce a human element*

Franco Fontana

Absence : Presence *These two pictures form part of a body of work in which Fontana introduces more of the human element into the frame*

This final picture—usually 30 × 40 cm —is printed on Kodak semi-matt or 3M paper or, occasionally, on Ciba if a particular collector prefers it for its longer life. Fontana himself is sceptical about the real durability of any type of colour print.

'Some take a month, some one and a half months, but in the end colours are lost. Even black and white goes yellow! The only thing you can do is to try and preserve the picture. The discussions about which papers last longest are meaningless to me.'

Fontana's equipment is simple. He uses basic Canon 35 mm SLR cameras and even with the electronic A-1 or AE-1 he prefers the manual mode. He uses four lenses, three of which are zooms—17 mm, 24–35 mm, 35–100 mm and 100–300 mm. 'In my recent work on shadows I use the 24–35 mm because this type of image is better covered by a wide angle.'

Fontana usually uses Ektachrome 64 Professional film, although he used to use ordinary Ektachrome 64. Ideally he would like to use Kodachrome, but feels that the standard of Kodak processing in Italy is not high enough.

Nevertheless, though technique is an important part of his work, Fontana continually stresses the importance of personal style.

Nowadays, he tries to convey this message in the photographic workshops which he occasionally teaches. 'I can teach my students the language of photography but they have to find the content—what they want to say—by themselves. Of course, you need technique but what is important, I think, is to allow the students to discover their own identity.

'I try to destroy in them everything that they've acquired from outside. You have to lose yourself to find yourself, otherwise you are always dependent on something. It's easy to work in a secure way, you're protected. Fear stops you from being free, being yourself. So I try and break that situation, to help them find just a little freedom. A week isn't very long—perhaps they'll come up with just one image. I can help them find the key, you understand, to open a certain door. Then the problem is theirs and they must make their own way.

'In my last course I told my students to go out and photograph everything they rejected. What they would never normally shoot, whatever they considered stupid. It's important because it's still a part of you, even if you hide it from yourself out of fear. All 18 students photographed the human figure—none of them had ever photographed it before. It was a question of fear or shyness, but when they were ordered to do it, they did it. They photographed people they didn't know in the street and in shops. Some of the pictures were banal, but its the approach that counts. They discovered themselves, began to break down the barriers which each of us puts up to stop himself from seeing. This helps you to understand other things.

In his most recent work, Fontana too is breaking down old barriers. The human shadows that have begun to appear in his recent works are symptomatic of this change in attitude. 'I've left the form—the scheme of things. Now I have started to include the human figure. Even in a timid form, it's there.

'Perhaps this will lead me to photographing people directly—I don't know. This might be a transition phase, but it may equally be the last interesting work I do. The critical reception has been quite pleasing. The critics didn't expect this break from me—it's more interesting, more complex and more ambiguous.'

Clearly Fontana will continue to develop his work along a highly individual line. The vitality and originality which he has brought to colour photography still remains a rich seam which, in spite of his large output, has scarcely been tapped.

Franco Fontana

Underwater cameras

Photography is not restricted to dry land. You can shoot underwater with one of the waterproof housings or underwater cameras available

Sub aqua range *This group of cameras and housings includes (left to right) the 110 Weathermatic, Ikelite housing, Nikonos IVa, Ricohmarine AD-1 housing with camera and the Hanimex Amphibian*

Dave King

Anyone who has ever tried sub aqua diving knows that the underwater environment provides the photographer with some beautiful and fascinating subjects. As more and more people have become interested in diving as a hobby, so the demand for underwater cameras and other equipment has grown.

The main problem involved in using a camera underwater is, of course, that of keeping the film and working parts dry. There are a number of cameras made with a watertight case which enables them to be used either in wet weather on land, or underwater. Underwater housings are impermeable casings into which ordinary cameras can be fitted to protect them. A part in the front of the housing allows light to reach the camera lens, while there are windows in the top or rear of the housing for viewfinding.

But sub aqua cameras and housings have to be more than just waterproof. Working underwater presents the photographer with a number of special problems. The water itself acts as a combined variable colour and diffusion filter, visibility is rarely more than 30 metres and is often considerably less, while refraction (the deflection of the path of light) underwater reduces the angle of the lens and can cause pincushion distortion and colour faults.

Limited visibility requires you to get very close to your subject in order to pick up detail. So, for photographing underwater landscapes, large creatures, or group shots of other divers, most underwater photographers prefer to use a wide angle lens. Occasionally, of course, you cannot get close enough to use a wide angle, so an underwater long focus lens must be used instead.

The problem of poor visibility is made worse by refraction. As light passes through the port in the housing, the change from water to air refracts or deflects it. A flat port can reduce the angle of view of the lens by up to one third, a 35 mm lens becoming equivalent to a 50 mm. Refraction can be partially 'corrected' by fitting a hemispherical or 'dome' port to the housing. With the lens properly positioned behind such a dome, the worst of the refraction effect is eliminated.

When it comes to choosing sub aqua

equipment, your decision will depend upon how seriously your take your underwater photography, whether or not you already own an SLR suitable for housing and how much you can afford to spend. The cheapest camera capable of being used underwater is a 110 model and can be purchased for about half the price of a budget SLR. Expensive underwater housings can cost as much as 100 times more.

Your choice may also depend on the sort of diving you do. Generally, the cheapest units only function satisfactorily at shallower depths—ideal for use when snorkelling but no use when deeper down. For deep water photography, more expensive housings are essential.

Underwater cameras

Cameras suitable for use underwater are those that have a perfectly sealed, often plastic, case to keep out water. There are two types: the all-weather cameras which are designed for use in wet weather but which are capable of being used underwater, and those that are specifically designed for the job.

The most elementary all weather camera is the 110 format Weathermatic made by Minolta (see page 1111). It can be used at depths down to 5 m, but the narrow angle of the lens means that it can only produce reasonable results in shallow, clear waters.

Hanimex, too, produce a 110 all-weather camera, the MF Amphibian. Slightly more expensive than the Weathermatic it has a depth rating of 45 m, motor drive and a built-in flash unit. It can also be fitted with an underwater close-up attachment. A more sophisticated version of the same camera is marketed by Sea and Sea under the name of the Pocket Marine 110. It includes all the features of the Amphibian but also has a separate flash facility.

Plastic bag *Though only suitable for use at moderate depths, this simple housing is inexpensive and robust*

Dave King/equipment courtesy of Ewa-Marine

Dave King/equipment courtesy of Nikon

Lens change *The Nikonos offers a range of interchangeable lenses, though some of them cannot be used out of the water*

A camera called the Aquamatic, which should not be confused with a company of the same name, takes the larger 126 instamatic cartridge. It has an interesting freeflooding design. The front of the camera containing the aperture and shutter mechanism can be flooded with water while the lens and film remain dry. This feature gives the camera a depth capability of 70 m—deeper than the requirements of most sub aqua divers.

One of the most versatile purpose-built underwater cameras is the Nikonos IVa. This is a 35 mm with a direct vision viewfinder. It also has a large, optional clip-on frame finder for use when wearing a face mask when it is difficult to get your eye very close to the built-in finder. The camera can be fitted with a large range of accessories produced both by Nikon and by independent manufacturers. These include dedicated flash, extension tubes and framers for extreme close-up and macro work and lens converters with which you can change a standard lens into a wide angle or fisheye. The range of lenses which can be fitted to the Nikonos includes a 90 mm and a 35 mm which have plane ports and have focal lengths of 120 mm and 47 mm, respectively, underwater. The other two lenses produced by Nikon for use on the Nikonos are fully corrected for underwater use and cannot be used on land. They are the 28 mm and 15 mm UW Nikkor.

The Nikonos IVa has an automatic exposure system metering off the film plane. It has a depth capability of about 70 m. This is deeper than most sub aqua divers are likely to go to. Although primitive by land camera standards, the Nikonos is one of the most widely used underwater cameras and can give results of the highest quality. For those underwater photographers who want the full versatility offered by a land camera, however, there is no alternative to an underwater housing.

Underwater housings

An underwater housing is a watertight enclosure which can take an ordinary camera but which enables all the controls to be operated from the outside. There are a number of ready built housings designed to take 35 mm or other format cameras while, for the DIY enthusiast, materials and control assemblies can be purchased and housings built at home.

The cheapest and simplest watertight housing is a flexible plastic bag with a rigid porthole. The camera is held in position inside by a plastic strap. Designed for use in wet weather or underwater, the bag is sealed with a clip and the camera can be operated by inserting a hand into an integral glove. The bags, called EWA bags, are available in a variety of sizes accepting all formats up to large roll SLRs. They are limited to a depth of 10 m and care should always be taken to avoid sharp edges which may puncture the bag.

Of a more rigid design is the Ricoh-marine AD. It is a clear, compact, polycarbonate case which accepts the Ricoh AD-1 or A-2 cameras. The cameras feature clockwork wind and programmed auto exposure systems and the 38 mm lens is coupled into the housing porthole for focusing underwater. Unfortunately, the rotating porthole mount which changes the focus becomes very stiff at great depths as a result of the increased water pressure. By the time that the maximum depth of 30 m is reached, the ring may be difficult to move at all.

Other rigid underwater housings are designed to take a larger range of cameras. But despite the growing popularity of underwater photography, the market is still very small and the equipment tends to be expensive especially if it has to be made to order.

Most 110, 35 mm compact and simple 35 mm SLRs can be fitted with housings of some kind, but those with interchangeable viewfinders are the most suitable. It is difficult to get close to the viewfinder when wearing a face mask so the action speed and system finders produced for the Nikon F range, the Canon F1 and the Pentax LX make focusing underwater much simpler due to the larger, brighter image.

Ikelite produce a comprehensive range of ready built transparent polycarbonate housings which can take cameras varying in size from 110 to medium format SLRs. Those designed to take 35 mm SLRs can accept most makes of camera. Costs are reduced by using the same outer moulding in all cases. The interior of the housing is custom built to suit the specific control positions of each type of SLR. Focusing, exposure and wind on are controlled externally through a series of gears and levers and all housings have interchangeable domed ports. The camera is fixed into the housing by its tripod thread in such a position as to allow viewfinding through the rear of the housing. Ikelites can be used down to the limits of safe air diving and cost

slightly less than the cameras they are designed to carry.

Slightly more expensive are the acrylic housings. These can either be bought ready made, or in component form for construction at home. Their acrylic construction makes subsequent modification or repair easy.

For the Canon F1 and the Nikon F series cameras, robust cast alloy housings are made. The cameras can be carried with or without a motor drive and acrylic windows in the rear and on top of the housing allow viewfinding and setting of controls. The housings feature interchangeable ports and fittings for flash arms and meters.

Another alloy housing with similar specifications that can accept a larger range of SLRs also has an optical reducer which allows for viewfinding using fixed finder cameras. With this attachment, the whole viewing screen can be seen but at a reduced size. This tends to make accurate focusing difficult, particularly with wide angle lenses. Alloy housings cost around half as much again as the cameras they hold.

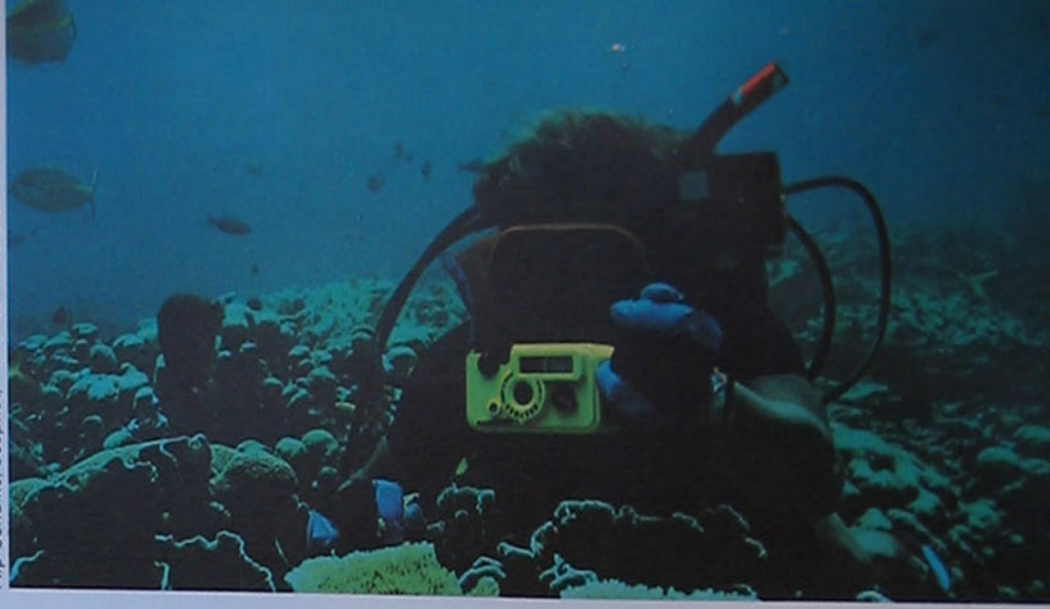
At the top of the price range are the underwater housings for medium format cameras. Although their high cost places them out of reach of the average amateur photographer, they might be a suitable item for group purchase by specialist sub aqua clubs.

Hasselblad produce a housing for their non-reflex SWC camera. In common with most of the more expensive housings it features the Ivanoff corrector. This device corrects for refraction at the air water interface and allows a flat port to be used with no reduction in the angle of the lens. The housing is made in robust alloy but with the corrector it is a bulky piece of equipment with a tendency to be front heavy.

For their EL cameras, Hasselblad make a stainless steel housing. It is tubular in shape, the camera being mounted with the lens located centrally. It has a depth capability of 300 m, but its size and construction make it heavy and unwieldy at all depths.

Just as large but easier to handle underwater is the alloy housing for the Mamiya RB 67. It features Ivanoff type correction allowing all but the 37 mm full frame fisheye lens to be used with a flat port.

Housings can also be bought custom made to fit your requirements whatever equipment you own. Before buying any housing, however, it is always worth checking to make sure that your camera can be housed. It should be capable of taking a wide angle lens and ideally should feature a range of interchangeable viewfinders. Compromising with an unsuitable camera or an inadequate housing could be a costly mistake and if you have little money to spend, an all weather camera might be the best introduction to underwater photography. On the other hand, if you already own a good SLR, and want to use it to its fullest capacity, a rigid sub aqua housing may be the best choice.



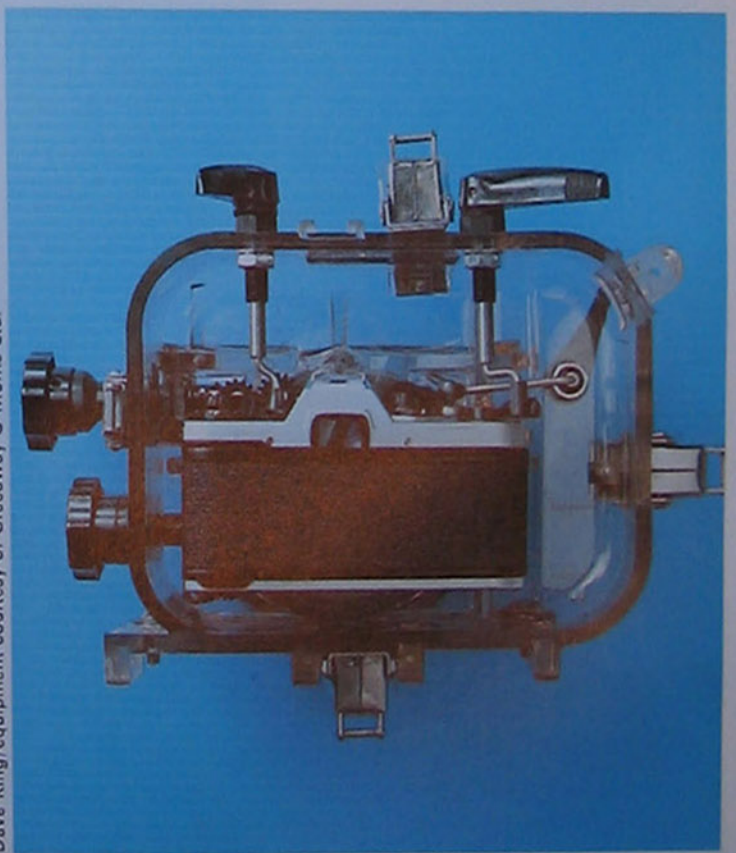
Flip Schulke/Seaphot/Planet Earth Pictures

In action *The separate flash facility on the Pocket Marine 110 makes this compact camera especially versatile*

Camera and case *Some housings, such as the Ricohmarine AD-1 here, are designed to fit specific cameras*

Dave King/equipment courtesy of Ricoh

Ikelite housing *Despite its curious appearance, this housing is extremely robust and simple to operate*



Dave King/equipment courtesy of Greaaway & Morris Ltd.

Improve your technique

Introducing an SLR

Teaching a beginner to use a camera requires tact and patience—functions and controls that you take for granted on a 35 mm SLR may seem far from obvious to someone who is used to a simple camera

The modern SLR is easy to use—once you understand what you are doing. But many people, used to instant-load cameras and completely automatic systems, are put off by the apparent complexity of an SLR. So you may well find yourself in the position of teaching someone to use an SLR.

You may, for example, want to teach another adult, or you might be introducing a child to photography. It can actually be easier to teach a youngster than to teach an adult, for two reasons. First, they are accustomed to being taught new skills, and are, as it were, experienced at being pupils. Second, you are less likely to assume that they already understand what is going on, and will not be surprised if they do not understand everything immediately.

Teaching an adult, however, calls for just as much skill, plus tact. An adult may be less used to learning, and may be unwilling to admit that they have not grasped a point. As a first principle, therefore, do not assume that what seems simple or obvious to yourself is

Michael Newton

Photo jargon *When teaching, avoid ambiguous words like 'fast'. It has three different meanings when applied to shutter speeds, films and lenses*

Discussing results *An important part of the learning process is looking at the results. Do not be afraid to point out where your student has gone wrong*

equally apparent or clear to a newcomer. Consequently, you should try to explain *everything*. It is all too easy to overlook some simple piece of information which leaves your pupil confused. For example, the word 'fast' means a lot to a photographer, and it is easy to assume that the newcomer knows what a fast film is. But the word still needs explaining, as it can apply to shutter speeds and movement as well as to films. There is no harm in stating the obvious—but to avoid being patronizing, you could take the approach 'as you already know . . .'—but make sure your pupil does!

Teaching any skill is not as easy as you might think—it is not simply a matter of telling the pupil everything you know. It is very important to plan your lesson in advance, and to have an outline of the order in which you will introduce topics. It is also essential to build up the lesson progressively, making sure that your pupil understands each item before

moving on. Ask questions to make sure. Above all, keep things simple. It is not necessary to understand how a camera works, or how film works, to be able to use a camera. And the complexities of choosing the right film, with the best combination of speed and quality for a particular purpose, can be left until the pupil is confident of using the camera.

We are assuming that your pupil has a straightforward manual SLR, with the exposure indicated by lining up needles, rather than being set automatically. The same basic outline applies to any camera, and to using a camera with no built-in meter, but with a separate exposure meter.

If the pupil has a camera with no meter at all, remember that every film carries with it an exposure guide. This gives the correct settings for the majority of conditions that are likely to occur—provided the camera is used outdoors.

A look around the camera

Though most people have a rough idea how a camera works, there are so many differences between a simple camera and an SLR that it is worth giving your pupil a guided tour of the camera and its features, naming each one. Point out that you will return to their functions later, so there is no need for the pupil to remember everything at once. At this stage, however, you will probably realize how complex a camera can appear to the newcomer.

There are three variable scales, all with numbers that are either similar or downright confusing—film speed, shutter and *f*-number. The *f*-number scale is the most awkward, since its numbers seem to run the wrong way and in an illogical sequence, though for very good reasons (see pages 64 and 47).

At this point there is a great temptation to show off your knowledge and explain just why the scales run like this. But this would be a mistake. It is not necessary to know the theory behind a camera's operation to be able to use it. That can come later. For the time being, therefore, avoid any technicalities that can be left aside.

If you are new to the camera itself, you may need to spend a moment or two examining it to identify each part. Fortunately, most cameras have many similarities, and the most important items can be recognized straight away. The aperture scale, with its numbers running in the sequence 2, 2.8, 4, 5.6, 8, 11, 16, is always on the lens barrel, and you can simply point out that this is one way of controlling the amount of light reaching the film.

The shutter speed dial can be either on the top of the camera or around the lens flange itself. It is recognizable by its numbers, which almost always run 30, 60, 125, 250, 500 and so on, with additional numbers on either end of the scale. Sometimes you need to lift the dial to change the speed. Point out that this is another way of varying the amount of light that reaches the film—a long exposure, such as 1/30 second, admits more light than a short one, such as 1/250 second.

You can add that the exposure the film receives is a combination of both the shutter speed and the aperture, but do not go into further details at this point.

It is a good idea to open the camera back, but make sure first that it is not loaded with film. If you are unsure, turn the rewind knob several times—if it moves freely, there is no film in the camera. A number of SLRs are opened by pulling the rewind knob outwards, but some have a catch along that edge of the camera, either centrally or at the botton edge.

With the back open you can demonstrate that a wide aperture and slow shutter speed allow much more light on to the film than a brief shutter speed and a narrow aperture. You can also show how operating the film wind lever turns the sprocket wheel, while the film take up spool often turns the other way to expectations. You should not load a film at this stage, however, as this will prevent your pupil taking practice shots with an empty camera.

The film speed dial is often incorporated as part of another dial, and is recognizable by its ASA or ISO numbers running 25, 50, 100, 200, 400 and so on. You will probably have to lift the dial or press a catch before changing the speed to a different setting.

You may be tempted to give a brief summary of the advantages of different films, but it would be better to leave this until much later. Simply point out that 'speed' simply means 'sensitivity of film', and that 'fast' means 'more sensitive'. Before going any further, set the film speed scale to a value that will enable your pupil to get reasonable values in the lighting conditions that prevail whenever you are demonstrating the camera. An ideal setting would be one which gives a reading of 1/60

Holding the camera *Bad habits are hard to break, so it is essential to teach the beginner the correct way to hold the camera firmly and securely*

Loading the camera

Although for your pupil's first film it is perhaps best not to complicate matters by explaining this before anything else, loading the camera must be taught at a fairly early stage. Many beginners find this relatively simple operation quite tricky at first.

Make sure you show exactly how the film is meant to go through the camera, engaging in the sprocket teeth and the film take-up spool. To show this clearly, it helps to wind the advance lever at least once with the camera back open—point out that this also ensures that the film has properly engaged in the spool.

You should make sure that you explain all the points to watch, as in some models it is more difficult to make the end of the film take hold in the spool, and it can slip out easily.

When you have wound the film once with the camera back open, close the camera carefully, and point out that the rewind knob rotates each time the film is wound on, acting as a check to ensure that the camera has been loaded properly.

second at *f*/8, so that the pupil can experiment with the camera.

Other features which you should point out are the film rewind button and of course, the shutter release. Try to call each feature by the same name each time, to prevent confusion.

Exposure

By far the biggest hurdle for both teacher and pupil is getting the exposure right. You must be particularly careful to present everything as simply as possible, in a logical order.

With the film speed set, explain that there are two ways of controlling the amount of light reaching the film—varying the shutter speed or the aperture. To make life simple, however, explain that you are going to set an average shutter speed—1/60 second is a good start.

All that can be varied now is the aperture. Show how the meter gives different aperture readings as the scene varies in brightness, by pointing the camera in different directions. All the pupil has to do is line up the needles and set the aperture as indicated. In effect, the camera is working as a shutter priority model, though manually, rather than automatically, operated.

With this basic information, your pupil could begin taking pictures at this point, and you could end the first lesson here, waiting to see the results of the first attempts. However, if you do decide to do this, explain the basic principles of focusing as set out below, so that the pictures come out reasonably sharp. It is also a good idea to encourage the pupil to handle the unloaded camera as much as possible, to get the feel of the controls.

If you want to continue the lesson straight away, pause at this stage to let your pupil grasp the idea of a higher *f*-number being used where there is more light. The beginner will find it fascinating to play around with the camera, seeing how the TTL meter needle moves across the scale as the aperture ring is moved. Do not confuse the issue at this stage, however, by talking about compensation for back-lighting or for certain types of subject. Keep it simple by repeating the hackneyed advice: 'Don't shoot into the sun', but qualify this by adding ' . . . yet'.

Analyzing results

The next step is to analyze your pupil's photographs, all taken at 1/60 second, for faults. If your pupil has not yet taken any pictures, you can use some of your own to illustrate the obvious faults. Failure to 'freeze' action, over- or under-exposure, and poor depth of field are the most common. The solutions to these problems may involve using a shutter speed other than 1/60 second, so you can demonstrate various possibilities.

Again, it is worth taking this step slowly. Point out to start with that each setting on the dials is called a 'stop', and that each stop represents a doubling or halving of exposure, so if you double one, you must halve the other, in order to get the same exposure. Show how 1/60 at *f*/8 becomes 1/125 at *f*/5.6 if you want to freeze the action of someone walking, or 1/250 at *f*/4 for faster movement.

At this point, try to get the pupil to ask the obvious question, which is, 'Why not use the camera at full aperture all the time?' If this is not asked by your pupil, ask questions yourself to see how much has been grasped. 'What would happen if it were a dull day and I wanted to take action shots? What would be the result of taking pictures at 1/1000 second all the time? Is it always a good thing to freeze all motion?' This question-and-answer technique is an important part of any teaching process, as it helps the teacher to check on progress and the pupil to show the progress made.

From these questions, you can show that a wide aperture (a small *f*-number) gives poor depth of field, while a slow shutter speed is likely to give camera shake, so a compromise often has to be made. Once this stage has been reached, leave exposure problems alone to avoid confusing the pupil.

Focusing

It may seem odd that people can have trouble focusing an SLR, since the viewfinder screen is specially designed to give exact information on focus. However, unless you explain this, the beginner may well forget to focus. Simple cameras either require no focusing, or have viewfinders which show everything as sharp. On looking through an SLR viewfinder, the beginner may well assume that this is simply the way the finder shows things, unless they are grossly out of focus, and shoot away happily.

Encourage your pupil to practise focusing, and take special care to explain how the focusing aids work, with the microprisms breaking up an

Learning to focus *To an experienced photographer, focusing an SLR is almost second nature, but to a beginner it may not seem nearly as obvious. Explain how to focus by using a subject that has both nearby and distant parts*

Explaining exposure *The concept of exposure is quite hard to grasp. You can make it easier to understand by opening the camera back, and firing the shutter at various combinations of aperture and shutter speed*

out-of-focus image. Emphasize the importance of accurate focusing on the most important feature of the photograph but do not dwell too much on depth of field at this stage. This can follow as a natural consequence of having to decide on what to focus on, and your pupil will probably ask for an explanation before too long.

General technique

Once your pupil has mastered the basics of focusing and exposure control, you can touch on the techniques of actually handling the camera. First, and most important, is holding the camera correctly. Explain that not only does this make for faster, smoother operation of the camera controls, but also helps eliminate camera shake. Your pupil should by now be sufficiently acquainted with the controls to adopt a good grip and operate them without fumbling.

Get your pupil to cup the camera body firmly in the left hand, so that the fingers can easily reach the focusing and aperture rings, leaving the right hand free to squeeze the shutter without supporting any of the camera's weight. Encourage the pupil to adopt a firm stance, with the elbows close to the body, for maximum stability.

You can also introduce the notion of framing the subject at this stage. Elementary rules can be mentioned, such as not including too much sky, or using a vertical format where called for. This should help develop an awareness of how the photographer controls the image which is reproduced on the film, by including exactly what is wanted, and leaving out what is not wanted. Do not, however, go beyond this, or it might become confusing and defeat the object of the exercise.

So far, you will not have explained depth of field to your pupil. Without dwelling on any complex theoretical explanation, you can now easily demonstrate, using the depth of field preview button, how unsharp images in the foreground, for example, become sharp on stopping down. Let the pupil put this into practice on different subjects, to develop an awareness of the function that different depths of field can perform in different situations—it is not always desirable to have everything perfectly sharp.

From now on, it is more or less up to you and your pupil to touch on different aspects as you go along. A discussion on framing the subject, for example, could quite easily lead to an explanation of angles of view, and interchangeable lenses. Try fitting a different lens, if there is one available, to illustrate the principle. When dealing with an exposure problem, you might take the opportunity to explain film speeds, or the techniques of exposing for backlighting, all of which are fully explained in other articles.

Using the meter *It is better to introduce the use of the exposure meter fairly gradually. Start by setting a fixed aperture and shutter speed. Later you can demonstrate to your pupil how the meter needle moves when the camera is pointed at light and dark subjects, and from here it is a small step to using the meter in the normal way*

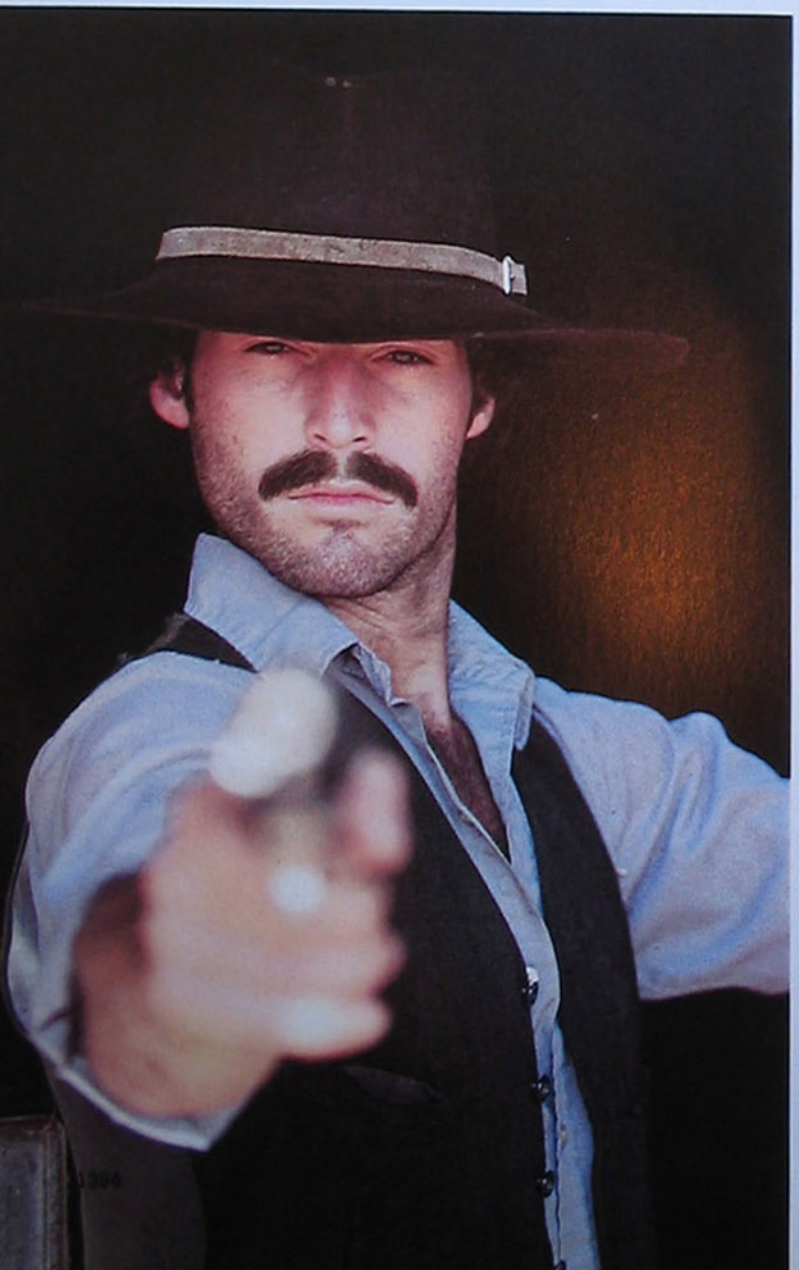
Michael Newton

Lens aperture *The iris diaphragm is vital for the proper control of exposure, but the series of f-numbers can be very confusing. Make things more simple by starting with the size of the hole, not the value of the f-numbers*

Assignment

OLD TUCSON

A film set recreation of an old American frontier town, Old Tuscon conjures up realistic images of the past



Wagon and horses *A combination of the rugged Arizona landscape and the antique means of transport gave a Western feel*

Hold it there ! *Cowboys were on hand to provide entertainment or pose for visitors. 105 mm lens*

Shuteye *Sergio stumbled across this amusing sight. A 28 mm lens, f/2.8, 1/30 sec*

Old Tucson was opened in 1940 as an elaborate movie set based on the original nineteenth century frontier town of Tucson, Arizona. In creating the town, much care was devoted to authenticity—even the adobe bricks were made locally out of materials from the area so that the buildings looked realistic. After over forty years of being exposed to the elements, the place has taken on a very realistic appearance—the wood has been weathered by the desert conditions, the paint has chipped and faded and the walkways have been worn by the tramping of countless feet.

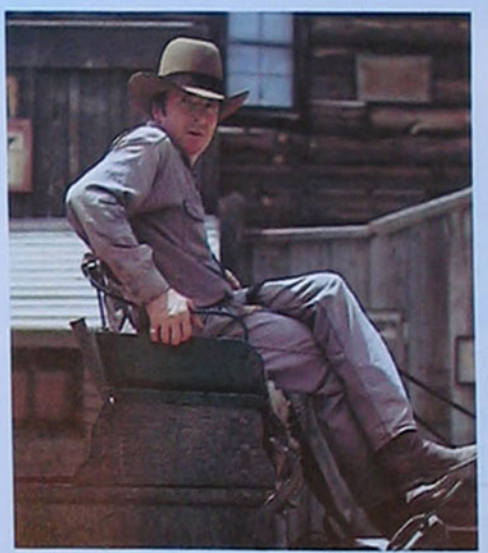
Sergio Dorantes felt that this would be an ideal location for a series of shots which conveyed some of the atmosphere of the Old West. One problem was that Old Tucson is one of the most popular

Sergio Dorantes

tourist attractions in Arizona—second only to the Grand Canyon—and the large crowds which arrive every day can easily spoil the authentic appearance of the place.

Since the town is used as a movie set, it is common to see actors walking around in old fashioned clothing with a film crew in tow. By framing his shots to leave out the cameras and other evidence of the film making, Sergio found that the actors could also be used to add an extra element to his photographs. However he felt that as a photographic device the inclusion of the actors should be limited—the mock cowboys are the subjects most visitors concentrate on.

For this assignment, Sergio adopted a purely pictorial approach—trying to



Actors on the set *The presence of a large number of actors working on a film contributed towards a more realistic appearance. Dim light meant Sergio had to hand-hold his 105 mm lens at 1/60 second*

On the wagon *The actors were used to cameras and in a way it seemed all to easy to photograph them. Wanting more of a challenge Sergio looked for details of the town for more interesting shots capturing the atmosphere of the place*

Pots and pans *Subjects like this are generally a little more difficult, depending more on imagination and on the photographer's ability to pick out interesting details which typify a place. 200 mm lens, 1/125 second*

Sergio Dorantes

Dummy passenger *The colours around Old Tucson seemed to be predominantly brown or grey so some extra colour was needed to liven up the shots. A polarizer produced richer hues*

End of the line *When using his 20 mm lens with a polarizer, Sergio had to make sure this combination did not turn the sky almost black. Careful framing made the cloud look like smoke*

Still life *Equipped with his pin sharp 55 mm macro lens—a Micro Nikkor—Sergio spent several hours of the day hunting for detailed close-up subjects. The lens was ideal for revealing subtle and delicate contrasts in texture*

produce well organised images which demonstrated thoughtful use of light, texture and perspective. This meant looking at the location very closely to figure out which subjects to include and then deciding on the best approach—decisions about composition, exposure settings, focusing, viewpoint and other variables which determine the success of the final image. As always, Sergio used Kodachrome 25 or 64 for all his shots. In most cases the light was bright enough to allow a shutter speed of about 1/125 second—even with slow film.

To produce successful shots from a location like this requires no special equipment. Sergio found that a wide angle lens and a medium telephoto were the most useful and felt that he could have tackled the job with just two lenses. For the most part the subjects were static and, when Sergio wanted to photograph people, he found that all the actors were willing to pose for anyone who asked.

Sergio finds that by making a point of arriving at a location like this just as they are opening for the day, brings benefits from both the more plensing light of morning and from the being able to take shots before the crowds arrive. In the case of Old Tucson, the fierce mid-day heat is avoided by completing the assignment as early as possible.

What went wrong?

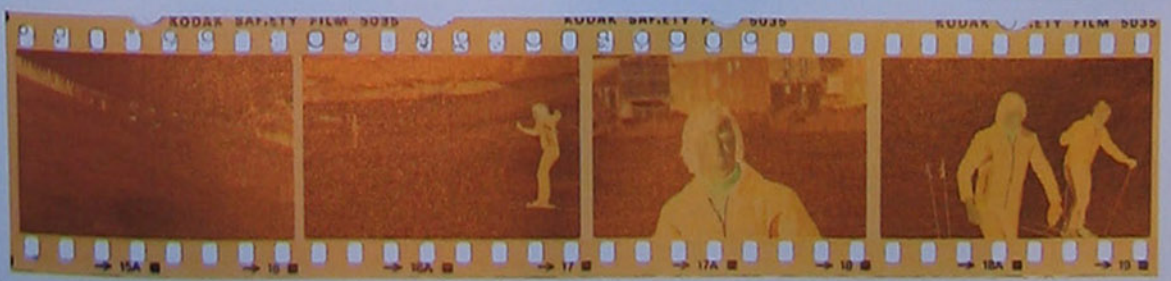
Winter pictures

If you are out and about with your camera this winter, take heed of some of these common problems to avoid severe mistakes

The above picture is underexposed because the meter reading was taken off the snow and no correction was made to the inflated reading. Opening up two stops gives much better results as the second shot shows. In such situations, bracket to ensure good results—especially for 'once in a life time' shots

The light bands on this slide were probably caused by moisture streaks on the film—remember to keep film stored safely sealed in the cassette

Winter light assumes many different qualities. A blue cast, often evident in shadows, is a feature which spoils many unfiltered snow pictures (left). Light levels, although seemingly adequate, may also be very low on a winter's day and, in such conditions, (centre) prone to casts especially early in the morning or very late in the evening (right)



The varying density of this strip indicates wrong exposure rather than faulty printing. The auto exposure camera used coped well with the skier (above) but not with plain snow

Trick photography

It is said that the camera never lies, but, in fact, it is quite easy to bend the truth a little. Even with a simple camera and a few techniques, there are many ways of making an 'unreal' image

Distorted images, unusual colour combinations, ghost images and false perspective—all these are photographic 'tricks', which you can do with almost any camera, and without any special equipment. By using a variety of simple techniques, you can obtain some startlingly unreal effects.

Using various coloured filters, for instance, you can make multiple exposures on colour film, giving unreal colours to certain parts of a moving image. You can also use the flare caused by out of focus reflected light to your own advantage, giving whatever shape you wish to the reflections. Both transparent and reflective surfaces can be used to make distorted or 'ghost' images in a variety of ways, while the *linear shutter* technique allows you to create striking images distorted in one direction only, giving an exaggerated illusion of speed. You can also falsify perspective to give out of scale effects, and change the apparent relative sizes of objects in a photograph.

All these techniques are rather unpredictable, and often a small change can produce radically different results. However, since you are experimenting, there is no such thing as getting a shot 'wrong'—you simply achieve the effect you want by trial and error. While this may mean using large quantities of film to achieve a given effect, you might also get an unexpectedly attractive result.

Colour movement

If you make three exposures of a moving object on the same frame of colour negative film, using a different coloured filter each time, each image of the object appears in a different colour. Where the images overlap, they show combinations of the colours of the filters used.

Any subject with a certain amount of movement is suitable—running water, clouds, washing flapping in the breeze—but a subject with bright highlights or white areas gives the most scope. The

Surreal sea *By making three multiple exposures through blue, green and red filters, moving subjects can be made to take on bright, fantastic colours*

Alma Samuels

effect is more interesting if parts of the subject are stationary, because if you use the right combination of filters the stationary parts of the subject are reproduced in their natural colours, while the moving parts show as separate, differently coloured images. For example, a person sitting in front of a fountain photographed in this way would appear in natural colours, while the moving water would be split into an infinite number of different hues. For this technique, the camera must be firmly fixed, to ensure that the three exposures are all in register.

The three filters must be in the primary colours, red, blue and green. You may be able to buy normal photographic filters in these colours. Otherwise, you must buy filters designed for making colour separations (see page 1180). These sometimes come in large sheets which must be cut down to size. You can either tape them to the front of the lens barrel or cut them precisely to fit a filter holder. Suitable filter sets would be Kodak Wratten no. 25 (red) no. 61 (green) and no. 38A (blue).

To make the necessary exposures, set the camera firmly upon a tripod and prepare to make a series of multiple exposures (see page 513). For each of the three exposures you must use a different one of the three filters. The order in which you use the filters does not affect the success of the technique and you can alter it freely.

Exposure should be established by experiment, but as a rough guide, take a reflected light reading from the subject —without a filter on the lens if you are using a TTL meter—increase the indicated exposure by one stop, and give that exposure through each filter. It is not advisable to take readings with a filter on the lens since the meter is affected differently by different colours —a red filter especially can make a meter under-read by up to half a stop. To increase your chances of success, it is best to bracket exposures when using this technique.

Colour negative film is most suited to this kind of special effect, because reversal film has a smaller exposure latitude. Colour negative film also allows you to correct the colour balance of the stationary parts of the subject at the printing stage. It is advisable, too, to use a lens hood, as filters can cause a large amount of unwanted flare.

Masks for highlights

When you look at bright highlights or reflections which are out of focus, they appear as bright discs in the viewfinder. These discs are the image of the lens opening or the diaphragm—the more out of focus the wider the aperture and the longer the lens, the bigger they appear. If, for example, you point a long telephoto lens at a sheet of water catching the sun, the entire picture consists of bright circles. If you keep the image out of focus but stop the lens down, the reflections take on the shape of the diaphragm itself—usually a hexagon. You can achieve the same effect by cutting out a mask in any shape you like, from black card, and placing it in front of the lens, either by wedging it behind a UV filter or by sandwiching it between two filters which you then screw into the lens. Alternatively, you could slide the mask into the mount used for slide-in plastic filters.

The reflections assume whatever shape you cut out of the mask, and the scope for experiment is considerable. You can, for example, use the reflections found in nature—solar reflections off water or shiny surfaces—but you can just as well make your own, indoors. By placing a background at a sufficient distance from an object and then defocusing it, you can make the object stand out against a pattern of stars, crescents or any other shapes you choose.

One way to obtain this effect is to set up a dark background made of card or cloth punctured with small holes, and to light it from behind, either with a lamp or with electronic flash. It is best, however, to have a continuous light source. Another way is to use crumpled foil lit from in front, and sufficiently out of focus for only the highlights to register.

These effects are most suitable for still life shots or portraits, where you want a special atmosphere.

You can also colour the shapes by using coloured lights, or even by making several exposures of the background alone, with different coloured filters fitted over the lens. By shooting the main subject reflected in a mirror on which you have glued small pieces of silver foil, you can make the bright out of focus shapes appear in front of the main part of the subject.

Image distortion

You can deliberately distort images in a number of ways, and although it is often difficult to control distortion, it can give interesting results.

Uneven glass The most obvious means of obtaining a distorted image is to photograph through a transparent substance of uneven thickness such as various types of glass or plastic panels and windows with patterns in relief. The variety of possible effects is considerable —as you move the camera and shoot from a different angle, the image becomes twisted or compressed into unrecognisable shapes. By excluding anything which gives the illusion away, you can obtain weird and often attractive distorted images.

It is best to use an SLR for this kind of effect, because the smallest change of angle makes a great difference, and since you often have to shoot quite close to the glass, the viewfinder of a non-reflex camera can be misleading. Remember, too, to focus on the image behind the glass, not on the glass itself.

With some kinds of hammered glass or moulded plastic, the subject is broken up into fragments, but remains recognizable in outline and colour, usually when it is very close to the glass. In this case, you can focus on the glass itself, and position the camera directly facing the subject rather than at an angle. By backlighting the subject you could obtain a fragmented silhouette, and if you shoot through coloured glass, an attractive coloured silhouette effect can be obtained.

Water baths Another way of distorting some small subjects—even a photographic print—is to place them in a shallow tray of water such as a developing dish, positioning the camera directly overhead. By ruffling the water surface or agitating the dish you can distort the image in various ways. Again, you should focus on the image, not on the water surface above it.

This technique is best suited to photographic images or lettering, but you could experiment with any flat image. It is important to ensure that the paper stays below the surface—resin-coated paper tends to float, so you should

Elizabeth Welsh/Tony Stone Associates

Distorted flower *Textured glass and plastic material can be used to break up an image of a familiar object into a brightly coloured abstract pattern*

Peter Dazeley

Starry eyed *If background highlights are out of focus, they form round discs of light on the film. But by putting a card mask over the lens, the shape of the highlights can be varied at will*

weight it at the corners, with coins for example. For large paper sizes, fibre based paper is preferable.

Remember that the water surface can show a reflection of the camera itself, so avoid this by adjusting the lighting carefully. If you use flash, the image will be sharp and clear, while by artificial light or daylight you can use slow shutter speeds, and blur the image.

Reflected images Any reflection is a distortion of the original image if the reflecting surface is not completely flat, and you can use this principle in a number of ways to produce distorted images.

Images reflected in water are distorted by the slightest ripple—much less than is required to distort an underwater image. To photograph a reflection in water, set up the subject and the water surface in reflection-free surroundings, such as a darkened room. Arrange the lighting to light the subject only, not the water, and focus on the reflected image, not the water surface. Again, by excluding all tell-tale signs from the picture, you can achieve completely unreal effects.

Similar effects can be produced using solid reflecting surfaces—you can use a highly polished print glazing sheet as a distorting mirror, or even the magnifying side of a shaving mirror. With the former, you can control the image by bending the sheet as required, and securing it in position with adhesive tape, while with a shaving mirror you must adjust the angle of the camera in relation to the mirror's surface.

With most mirrors, you obtain a secondary image, caused by the layer of glass which covers the actual reflecting surface. Front-surfaced mirrors, like those used on SLRs, can be used, but they are fragile and expensive. With a metal sheet such as a print glazing sheet, this secondary image does not appear, because the image is reflected directly from the surface.

Ghost images

By using a special semi-silvered mirror, you can produce 'ghost' images. This type of mirror, also known as a 'two way' mirror, is only partly coated with reflecting material, evenly distributed all over its surface. If an object placed behind it is sufficiently illuminated, it is visible as well as the reflected image, and can appear to be part of it. Since this type of mirror is used for interior decor, it is available in a variety of sizes.

Ghost image shots are most easily done indoors. Set up the camera and the subject in front of the reflecting side of the mirror, so that the subject is visible in the viewfinder. The camera and subject must be opposite each other, at the same angle to the mirror's surface and at the same distance, if possible. Position the second subject behind the mirror, so that the two images coincide. Remember to focus on the images rather that the glass surface.

The lighting for the second subject depends on the reflection rating of the mirror, but almost always has to be stronger than that for the reflected subject. Adjust the lighting for the balance you require, bearing in mind that the contrast of the image as seen in the viewfinder is less than that you obtain on the film.

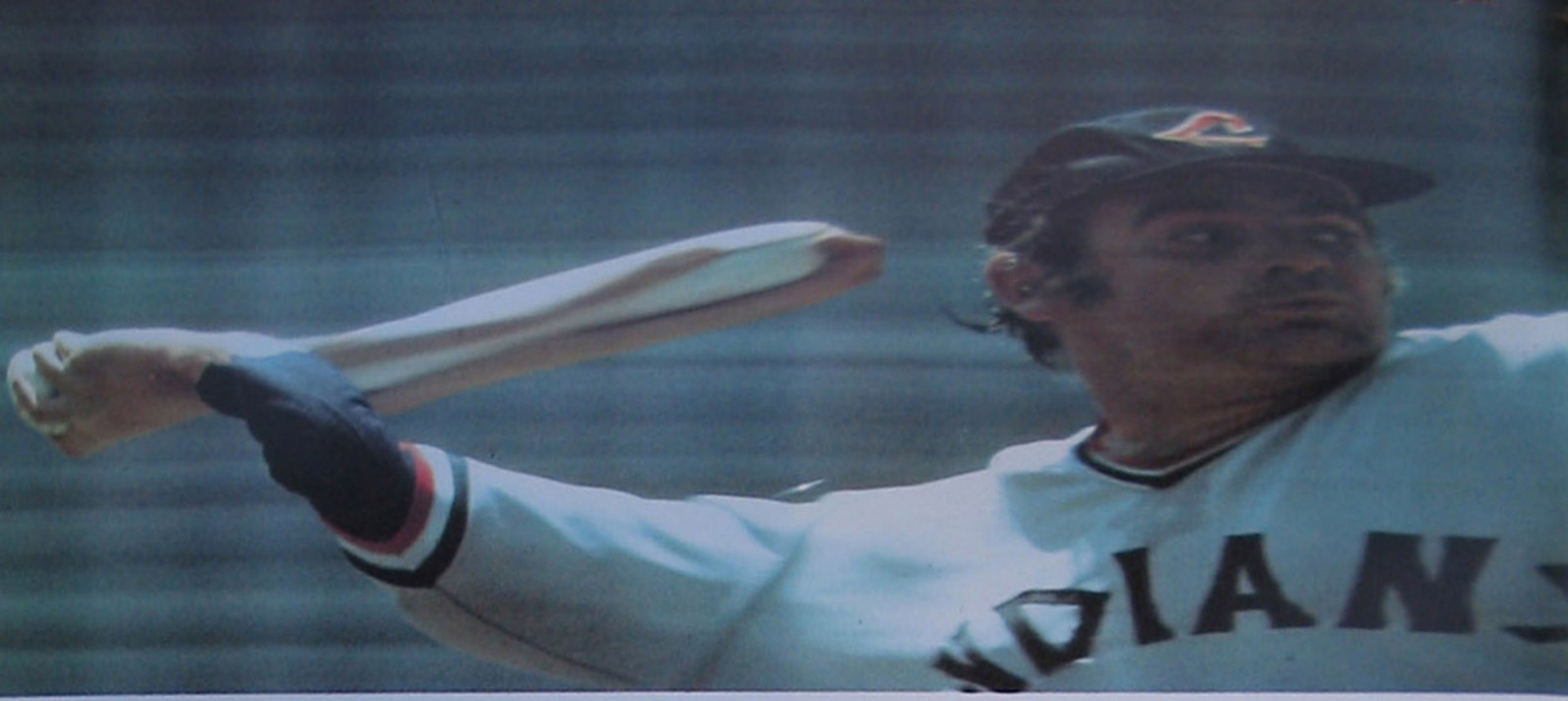
It is important to light only the portions of the subjects you want to reproduce—or you might find that unwanted elements of background intrude on the picture and conflict with each other. Alter the lighting to suit the effect you want—the scope is tremendous.

Figure in a bottle You can photograph a figure 'in' a bottle using this technique. The bottle must be larger and therefore closer to the mirror, but it does not matter if it is in front of the mirror or behind it. Light the bottle in such a way that a dark space is left in the middle, where the figure will be. This is not difficult, because glassware is easily lit as an outline.

Place the person in such a position that they appear to be in the bottle when viewed through the viewfinder. The figure should be set against a dark background that does not intrude and

Reflected landscape *Distortion is made possible by using reflectors. Here a piece of flexible plastic mirror is being used to add a new twist to landscape*

Wilf Woodhead



Linear shutter *A special slitscan camera was used to shoot this distorted image, but even with a simple camera and a few very simple techniques, you can easily take similar pictures*

destroy the illusion. If the bottle's background is included, it must be definite enough not to appear as a ghost image.

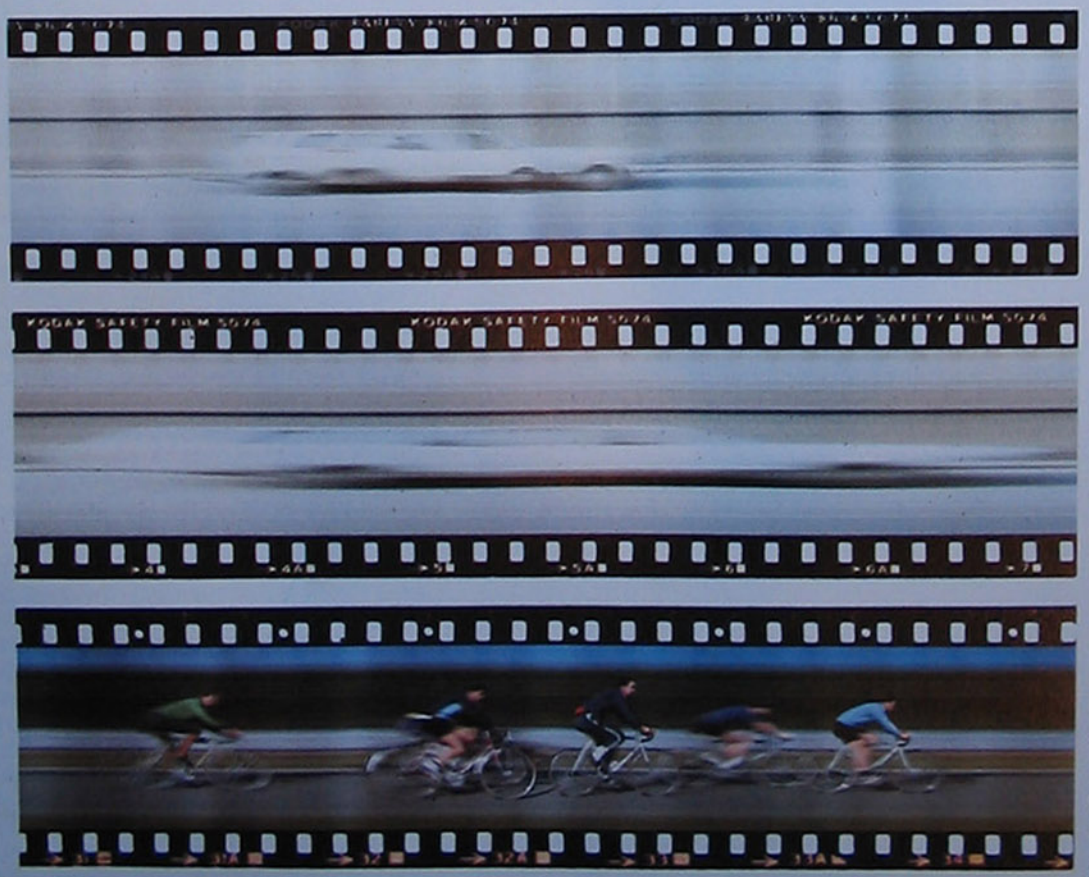
Since the bottle and the figure are at different distances from the mirror, use the smallest aperture possible, to obtain maximum depth of field—it may even be necessary to use a wide angle lens to ensure that both bottle and figure are in focus. With this effect as with others, the only way to achieve the result you want is trial and error.

You can sometimes produce the same illusion using a sheet of normal glass—here, too, the effect you produce depends on the relative strengths of the lighting used on the different elements in the shot. With either method, take care to eliminate extraneous reflections from the glass itself, which can obscure the parts you want to photograph completely.

Linear shutters

Even more dramatic distortions of moving subjects can be achieved using a linear shutter. This attachment, which fits over the front of the lens, consists of a mask with only a narrow slit which lets in light. As the exposure is made, the film is wound back manually through the camera, and the subject, recorded only through the narrow slit, is grotesquely lengthened or shortened in the direction of the film movement.

To use this device, first fit a wide angle lens such as a 24 mm or a 28 mm. With the cap over the lens, wind on and release the shutter until the film is completely wound on the take-up spool, as if it had been completely exposed. Place the camera on a tripod, and, removing the lens cap, fit the linear shutter on the front of the lens. Set the



Gavin Cochrane

Edouard Berne/fotogram

Movement and distortion

The major problem with the slitscan technique is matching the speed of the subject to the film rewind speed. Failure to match them results in a distorted image. Also, vertical strips of uneven exposure are caused by jerky film wind. The top picture was taken by hand-winding the film as the car drove past at 35 k/mph. The shape is recognizable, but unevenly exposed. When the power rewind on the camera's motor drive was used to eliminate any uneveness, the outline of the car was stretched out of shape. Results like those in the lower picture require plenty of practice. It is probably better to start with black and white film, as this allows you to see the results very quickly, and then move on to colour as your skill and confidence increase.

Neil Leifer/Sports Illustrated © Time Inc./Colorific

camera shutter on B, and lock it open with a cable release. Press the rewind release catch on the camera, and, as the subject moves past the camera, rewind the film several turns back into the cassette. When you have made the exposures you want in this fashion, you can unlock the shutter release button, finish winding the film back into the cassette, and develop it normally.

When rewinding the film, try to do this as smoothly as possible—ideally, a slow electric motor should be used. The relation between the subject movement and the film movement determines distortion. If, for example, you rewind the film rapidly and the subject is moving across the frame in the opposite direction, it will be elongated; if it moves in the same direction as the film, it will be compressed.

With experience, you can learn to 'follow' the subject, and, depending on the irregularity of the movement, produce the most strange and unexpected results on the film.

Exposure when using a linear shutter is also a matter of trial and error, since the light reaching the film through the slit in the shutter is governed by the speed at which the film is rewound. However, as a rough guide, set the lens to a medium aperture, such as *f*/8, in bright sunlight.

Perspective effects

Because a photograph is a two-dimensional representation of a three-dimensional subject, the viewer relies heavily on the impression of perspective to perceive the illusion of depth (see page 1278). By interfering with the way perspective is recorded in a photograph, you can create out of scale effects such as, for example, a figure apparently standing on a hand, but actually much further from the camera than the hand.

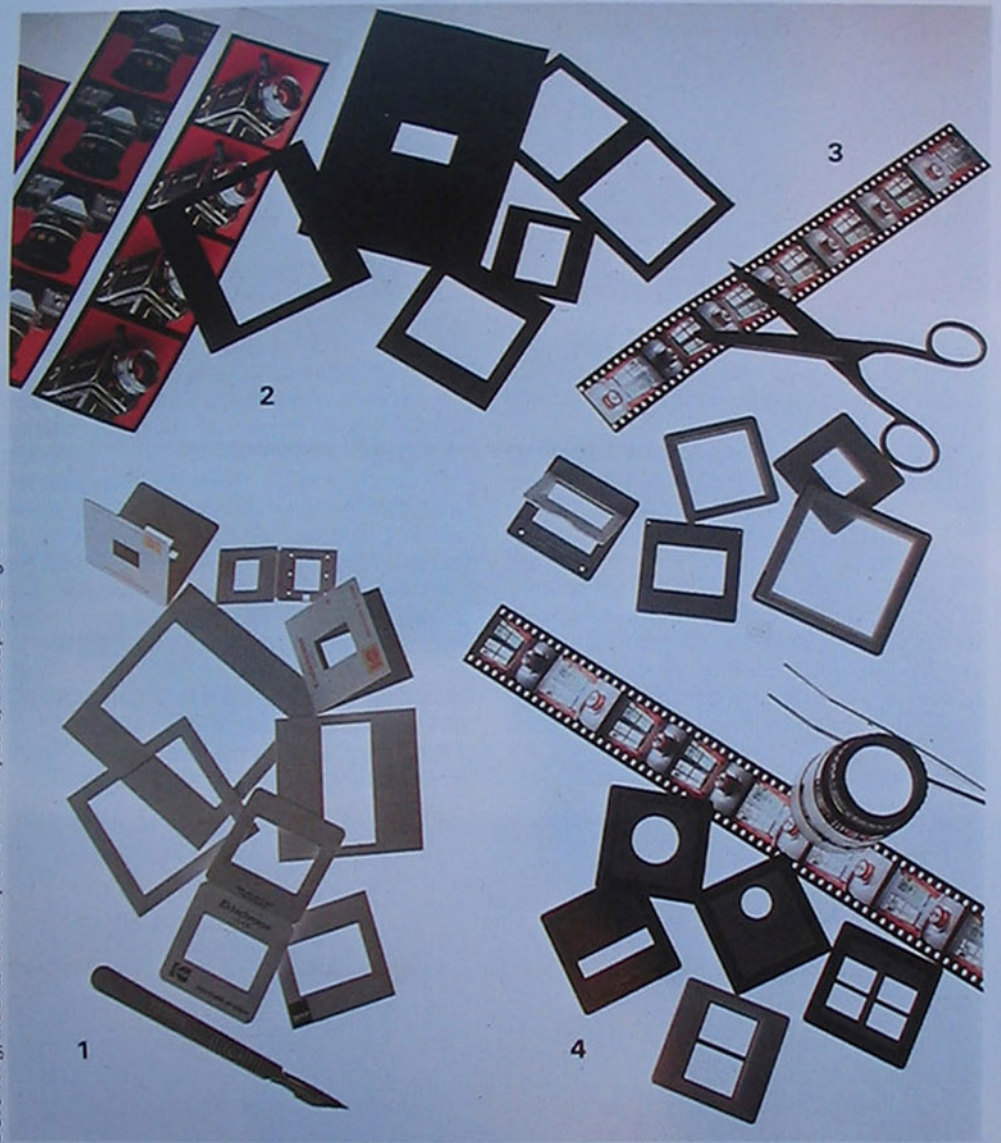
To do this it is essential to remove all elements in the picture which give clues to distance—without making the remaining elements look like cut-outs. The hand itself can conceal what is supporting the person. It is important to use lighting of the same type for both the figure and the hand to make it look as if they are both lit by the same light source. The ideal background to such a shot is a plain one such as a blank wall.

Often, the illusion is helped when the two elements are at some distance from the camera, especially as this helps you obtain good depth of field. A distant viewpoint compresses the apparent distance between objects, thus helping produce the illusion. Try selecting a low camera angle, as this, too, tends to falsify perspective. Carefully falsifying visual clues to depth in photographs (see pages 1278 to 1281), can give some weird perspective illusions.

Sun trap *Some of the most spectacular effects are very simple to achieve. This perspective trick was just a matter of the right camera angle*

Slide mounts

Having slides mounted professionally is convenient but by doing the job at home you can select the best slides for mounting, choose the format and save money



Dave King/mounts courtesy of DW Viewpacks, Photopia & Agfa

Range of mounts *A wide range of mounts is available for most formats. White card mounts (1) are the cheapest and are easy to write on. A transparency stands out clearly in a black card mount (2). Sturdy plastic mounts (3) can be bought either plain or with two glass sheets to hold a slide flat. Creative mounts are available (4) for decorative mountings and masking*

With some slide films, you have little choice in the way your slides are mounted—the initial cost of the film includes processing and mounting in the manufacturer's normal manner. With films for which processing is paid for separately, however, you must specify the type of mount you want or cut and mount you own slides.

While professional mounting is undoubtedly convenient, doing it yourself has its advantages: there is less risk of damage to irreplaceable film by the mounting machines now used in modern processing labs; you choose exactly which slides you want to mount—which saves the cost of having poor images mounted automatically; you can also crop images to your own taste and may even be able to correct mistakes in particular shots, such as an off-level horizon. Whatever you choose to do however, you will have to decide just what type of mount to have, and this depends on how you want to use the transparency, how much you want to pay and what format camera you use. For 35 mm slide film, the range of mount types is very wide while for other formats it is much more limited—so what is available?

Types of slide mount

There are many types of slide mount but most can be divided into one of two broad categories: those for projection—which is the most important category, certainly for amateur use, and which includes card mounts, plastic mounts and glass mounts; and those for handling or display—which consists mainly of overlay mounts. This is not to say, however, that card or plastic mounts cannot be used for general handling or storage purposes. On the other hand, overlay mounts cannot be used for projection.

Your choice of mount basically depends on how much you want to pay, what sort of use they will have and how long you want them to last. By far the most popular and commonly used, though, are the card and plastic mounts.

Card mounts

The simplest mount is the card type—usually white or grey in colour. The two sides of the mount are folded over with the slide sandwiched between and either heat sealed or stuck together with a self-seal adhesive.

Heat sealed card mounts are the kind usually used for most commercially processed slides because they are cheap and well suited to large scale mechanical mounting. They are not generally available to the public, however, and attempts at DIY heat sealing are rarely completely successful.

Removing dust *Glass mounts tend to trap dust so a blower canister should be used when mounting slides. Failing this, a blower brush is adequate*

Self-adhesive type card mounts are widely available and much more suitable for home mounting. Unfortunately, the adhesive often comes apart after a lot of handling, and it is difficult to align the film and the two halves of the mount accurately. Crooked slides look odd in a slide show and a badly sealed mount may jam in the projector.

Jamming may also occur when projecting card slides that have become dog eared or battered by overhandling. If the autochange mechanism on the projector is very fierce, buckling may be severe enough to damage the film itself. A further problem with card mounts is that they tend to show rather ragged edges on the framed area of the projected image. Even if they are crisply cut to begin with (and many are not) the adhesive picks up hairs and dust which always show on the screen.

The advantages of using card mounts, however, usually outweigh the problems as far as slides for general handling, if not for projection, are concerned. And this is borne out by the fact that most professional users use them for mounting and showing slides intended for publication. They are cheap; information can be written or printed directly on the mount; and they can be cut or marked for identification.

Plastic mounts

Plastic slide mounts are an alternative to card types, are only slightly more expensive and a wide range is available.

The cheapest are the fold-over types which are simply plastic versions of the card mount. Press-together type mounts come in two halves with snap studs to hold them together. Moulded-in guides help you locate the slide correctly. More expensive are the slip-in type where the slide is fitted into a hinged section which swivels into the mount casing.

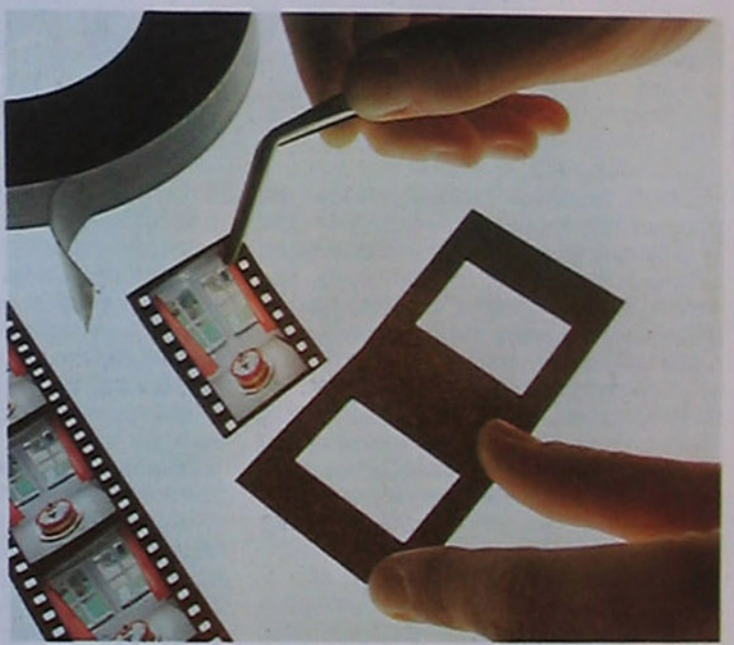
Plastic mounts are rather better for projection than card types. The problem of dirt and dust around the image edge is eliminated. They are rigid and therefore less likely to cause jams and they are much easier to use. Further, they come in a variety of thicknesses, the range being approximately 1½ mm–4 mm. Some projectors work better with one type or the other. A good test of your projector is to try it out with a variety of mounts of different thicknesses and see which type works best.

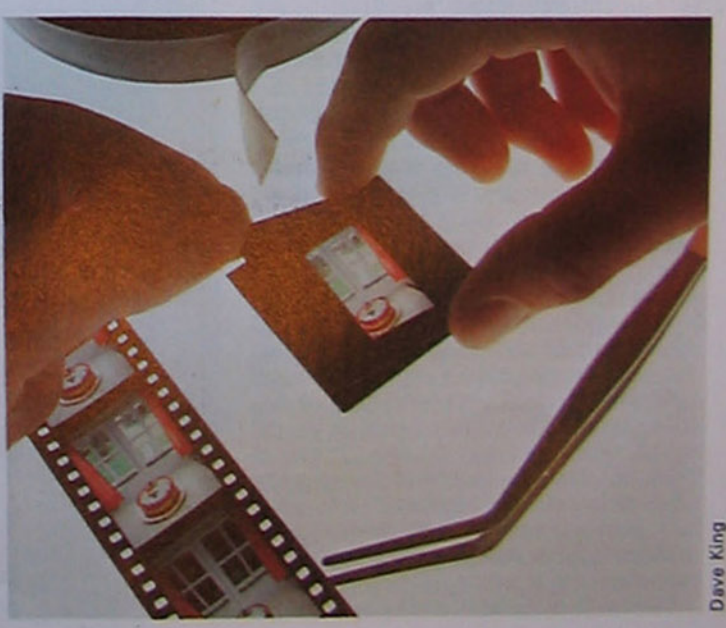
Specific disadvantages, when compared to card mounts, are that plastic slides are difficult to write on and cannot be cut for identification. Storage, if you have many slides, is also less economical as the mounts are much thicker than card types and, therefore, fewer fit in a box of a given size. A rather minor point is that stacking plastic mounted slides, for example, while you have them out on a table top, is tricky—they tend to slip around and this can prove most irritating.

Card and plastic mounts suffer from two major drawbacks. The first is that they offer no protection to the surface of the transparency. It can easily become marked with fingerprints or stains from careless handling. Unless these marks are removed promptly, they can become permanent. The problem can be minimized of course by storing the slides in magazines and handling them as little as possible.

The second drawback of simple plastic and card mounts is less easily overcome. Because film has a slight natural curvature, these mounts grip the slide firmly by the edges to keep it flat. Unfortunately, this means that the film cannot expand sideways when it is heated in the projector and consequently it bulges outwards either gradually, as it warms up, or quite suddenly causing it to 'pop' out of focus. This is irritating enough in an autofocus projector but on a manual version it can be infuriating.

Card mounting *requires a little care. Making sure that both mount and transparency are free of dust, align the slide in the adhesive mount using a pair of tweezers. The mount can then be firmly folded over*





Dave King

Dave King

Other types of mount reduce the problem of popping by securing the film at only one point so that it can expand sideways as it heats up. However, this means that some of the film's natural curvature remains causing projection problems, since most projector lenses are designed to project a flat slide. If the slide is curved, they cannot hold it all in focus at once, so either the centre or the edge of the image is out of focus. The problems of slide protection and popping, though, can be solved by using glass mounts.

Glass mounts

Glass mounts have a plastic body but contain two small pieces of glass set into the cut-out in the middle. They both protect the film and hold it flat. Fingerprints or other marks can be wiped off the glass, or at worst the slide can be remounted in a clean mount. Because the slide is sandwiched, it cannot pop either—it must expand sideways instead.

Glass mounts are the type most often used in professional audio-visual presentations because they hold the film in more precise vertical and horizontal alignment than glassless slides. This is particularly important if fades and dissolves are being used to add effect. For perfect precision, special registration mounts are available which locate the film by means of the sprocket holes. Such mounts are very expensive, however, and are only worthwhile if the camera used for shooting the film, and the projector, are of top quality.

The main drawback with glass mounts is that the glass can break. Though this rarely happens in ordinary use, it can pose problems if the slides need to be mailed—indeed you should not do this. Should a slide break in use, the pieces of broken glass may be ground against the image and ruin it.

Glass mounts also require more care at the mounting stage. Instead of two surfaces to attract dust, there are six.

Another problem with glass mounts is that they can produce an optical phenomenon called Newton's rings. These arise when two transparent surfaces are held in slightly less than perfect contact. If they are separated by a distance about equal to the wavelength of light, coloured rings appear as a result of optical interference. Newton's rings can to some extent be prevented by using special glasses, although these add more to the cost of the mounts and in any case are not completely effective.

Mounting press *This device makes accurate mounting much easier. A small built-in light box illuminates the transparency to facilitate alignment in the mount. When the lever is pressed down, the mount is snapped shut neatly and accurately. Since you need not handle transparencies, the machine ensures cleanliness as well as accuracy —it should, however, be kept clean*

Dave King/press courtesy of Marchant Photographic

Dave King

Overlay mounts *Where several slides are to be examined but not projected, these mounts are ideal. They can be handled without risk of damage*

Cropping *Part of a transparency can be masked off with thin black tape. Ensure that the slide and mount are clean, and trim off any excess tape before folding*

Overlay mounts

If you want to mount your slides purely for easy handling or for examination, for example on a lightbox, rather than for projection, you can use overlay mounts. These are simply black cards, folded double, with a cut-out, behind which the frame of film is taped. Overlay mounts are much larger than the transparencies they contain and are enclosed in a vinyl envelope which is clear at the front and frosted at the rear. They are easier to handle than projection mounts, provide good protection and allow transparencies of different sizes to be presented in a uniform way. Picture agencies often use them because the black frame enhances the quality of the image.

Slide mount formats

Two dimensions are used to describe slide mount size—the outer measurement along each side, and the inner or frame size. The frame size of the mount is always slightly smaller than the actual image size of the transparency. On 35 mm slides, up to 1 mm may be lost all round, while on 6 × 6 cm slides, the loss may be as great as 3 mm all round. This point is worth bearing in mind if you like to compose your pictures right up to the very edges of the frame.

The most common size of mount is the 5 × 5 cm with a 23 × 34 mm image area. If you own a 35 mm camera, this is the mount into which your film is normally fitted. Other film sizes which can be mounted in 5 × 5 cm mounts and used in all projectors designed to accept this size are: 110 format, 16 mm, 18 × 24 mm, 24 × 24 mm, 28 × 28 mm and 40 × 40 mm. The frame areas, of course, vary in size to suit the type of film. Most of the major mount manufacturers offer all these formats although it is often difficult to buy them in the cheaper ranges.

There are two other standard outer sizes—3 × 3 cm (which is sometimes used for mounting 110 and sub-miniature format film) and 7 × 7 cm (used for rollfilm sizes up to 6 × 6 cm). Picture agencies and photographers who frequently lend their transparencies to publishers, and advertising agencies, often mount their slides in the large format type but because of the difficulties involved in projection neither format is widely used by the amateur.

Obsolete mount sizes include the old 3¼ × 3¼ inch lantern slide, various stereo formats and those peculiar to particular manufacturers.

There are also a number of so-called 'creative' mount formats. Usually these are made to fit only full frame 35 mm film. They consist of masks of various shapes —long, thin, panoramic types, small squares, circles and ellipses, TV screen shapes and even hearts, stars and keyholes, through these are no substitute for creative images.

Should you wish to crop your slides, to get rid of unwanted details, or perhaps to strengthen the composition, you can use very thin black tape. This is applied to the actual film so it is important not to use tape where the adhesive spreads as this attracts dust, making the edges of the picture look very ragged. After masking, the tape can then be trimmed and the slide mounted normally.

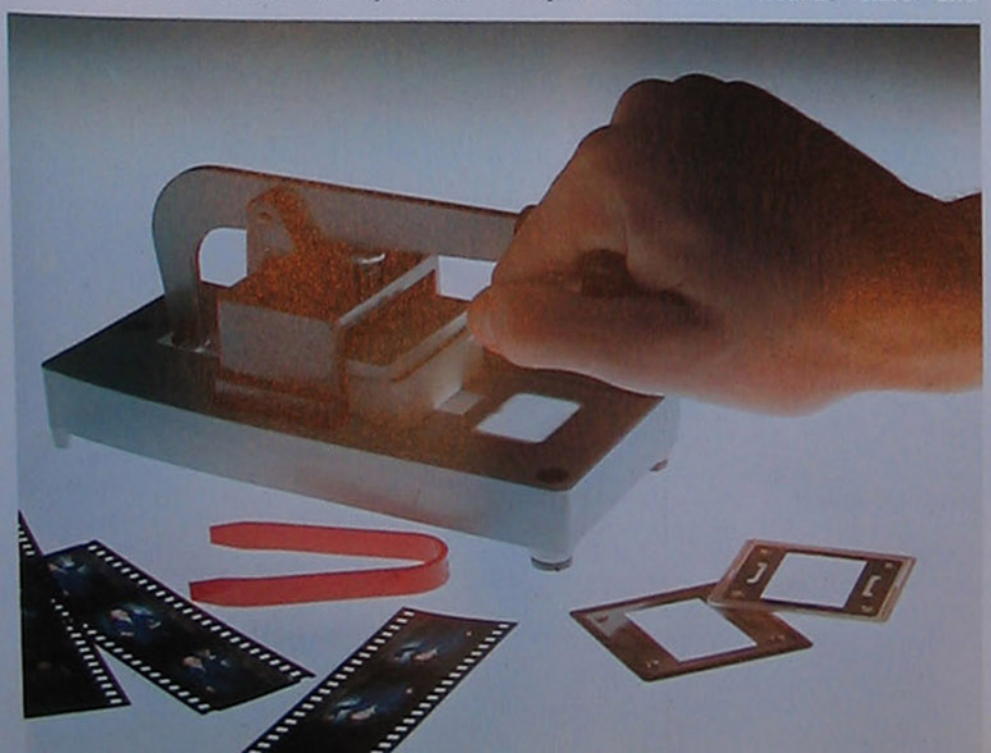
Mounting accessories

Slides can be cut and mounted using little or no special equipment but some items make the job much easier. A lightbox helps you to judge exactly which slides are worth mounting and makes them easier to cut accurately.

For most mounting jobs, scissors perform perfectly adequately as a cutting device. But if you have a lot of mounting to do, then mechanical cutters and mounting presses may be worth considering. One manufacturer produces a mounting press which includes a built-in lightbox for highly accurate transparency positioning.

A problem involved in using any mechanical equipment for slide mounting is that it gets dirty. Slides and equipment should always be kept meticulously clean during all the stages of cutting and mounting. For glass mounting a soft duster is ideal for removing dust. Preferably it should be antistatic. A blower canister is also extremely useful. For perfect cleanliness, thin cotton gloves should be worn and hands should be washed with watchmakers' soap.

If you follow these simple precautions, there is no reason why your slide mounting should not be every bit as good, if not better, than that obtainable from the processing laboratory. All slide mounts are relatively cheap but for best protection and projection it is worthwhile paying a little extra for plastic or glass mounts.



The progress of lens design

The first lenses used for photography were very simple. But more complex lenses soon began to appear using various combination of elements based on a few fundamental designs

Victoria & Albert Museum, London

On the beach *Early pictures like this show severe loss of sharpness at the edges, as simple lenses were used*

The way a photograph looks depends very much on the lens that was used to take it. So the development of lens design is a crucial aspect of the development of photography generally. The first lenses used were very simple. But it was soon found that combining lens elements in certain ways gave much better results.

Glass lenses were in common use well before the advent of photography. Refracting lenses were described in the 13th century by the Arab scholar Alhazen, and spectacles were in use by the end of that century. Simple biconvex lenses (see page 1266) were later widely used in optical instruments.

One problem with early lenses was chromatic aberration—colour faults. But this was largely solved by the English optician Chester Moor Hall who devised *achromatic* correction. The first achromatic lens, produced by Dollond in 1758, used two elements cemented together as a *doublet*. The elements were made from different types of glass (usually crown and flint) with different refractive indices. One element was positive and one negative, and in this way the dispersion of colours caused by one element was cancelled out by the opposite dispersion characteristics of the other.

Lenses for photography

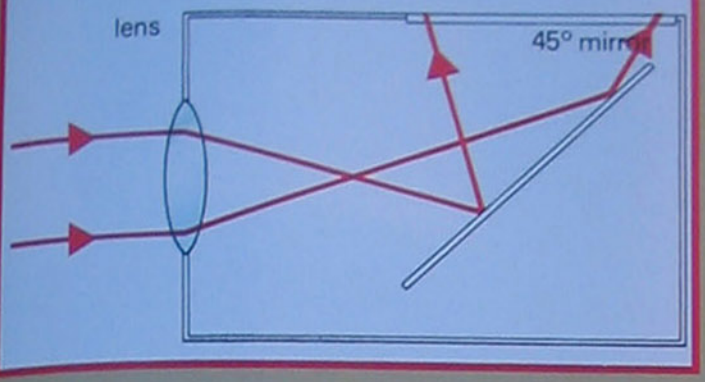
In spite of these developments, early cameras used very simple lenses. The *camera obscura*, a sketching aid used by artists, was the direct ancestor of the photographic camera. This originally used a single element biconvex lens which suffered from numerous aberrations including coma, which causes image streaks at the edges of the field, and curvature of field. But in 1812 the camera obscura image was improved by Wollaston who altered the lens shape to a meniscus, with the concave side to the subject. The meniscus shape was found to give a flatter field, and a fixed aperture stop was put in front of the lens so that only the centre of the lens was used, which reduced coma and spherical aberration.

The image still suffered from distortion and chromatic aberration, but such lenses were used for early photography, and for decades after in the simple box camera. The chromatic aberration was not very important as the emulsions of that time were only sensitive to blue light and so the colour fringes did not show up in the picture.

In 1829, Chevalier replaced the meniscus lens by a more expensive achromatic doublet, and this design was frequently used for photography until the 1860s. This lens, known as the *Landscape* lens, was used by Daguerre on a modified camera obscura to make his daguerreotypes. The main limitation was a small working aperture of about *f*/11 which had to be used to reduce spherical aberration so that the image was sharp, though some other faults remained.

The early photographic processes such as the daguerreotype and the calotype were very slow, and the small apertures of existing lenses meant that long exposure times were needed. But in 1840, the mathematician Petzval devised a lens with an aperture of *f*/3.7, around 10 times faster than existing designs. The lens used two doublets, and was found to give excellent correction for spherical aberration as the second doublet could be used to cancel some of the aberrations caused by the first. This allowed larger apertures, especially if only the centre of the field was used, and the image quality at full aperture was good enough for portraiture. The design was intensively developed and improved and is still sometimes used for large aperture long focus lenses, especially for aerial reconnaissance and projection.

The camera obscura



The symmetrical lens

The idea of using one lens group to cancel out the aberrations of another led to the technique of *symmetrical construction*. Such a lens had two identical lenses mounted either side of a central aperture stop, so that the rear element or group is effectively a 'mirror image' of the first. When an aperture of *f*/16 or smaller was used, the lens was found to be completely free from distortion and tolerably well corrected for lateral colour and coma.

Although symmetrical lenses gave good image quality over a wider field of view than the Petzval design, they tended to be very slow. But in 1866 came the famous Dallmeyer Rapid Rectilinear lens (see page 932). It was called 'rapid' because it had an aperture of *f*/8 rather than the more common *f*/16, and because it was free from distortion. Both improvements were made possible by the availability of different types of glass.

To this day, the symmetrical lens, and derivatives such as the Schneider Symmar-S and Super Angulon types, are used for large format cameras, giving superb definition and wide fields of view, though the maximum apertures still tend to be quite slow.

Early symmetrical lenses, and the Rapid Rectilinear in particular, were very popular. Their main disadvantage was that, in common with other lenses of that time, they were *astigmatic* lenses—that is, they suffered from astigmatism and curvature of field, the latter making the pictures unsharp at the edges of the frame.

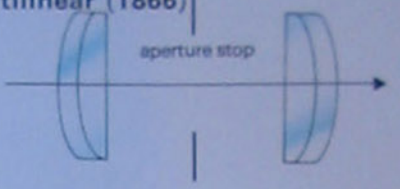
But in 1886, the German Schott works introduced some new types of glass which had high refractive indices and low colour dispersion. These glasses were produced after extensive collaboration with the optical pioneers Zeiss and Abbe, and made possible new *anastigmatic* lenses which had greatly reduced astigmatism and gave an image with reasonably flat field.

The new types of glass allowed designs to be used which would have been impossible with previous types of glass, or which would have given an unacceptable amount of chromatic aberration. All lenses today are *anastigmats*.

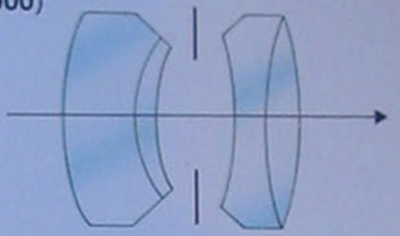
Nigel Osborne

Symmetrical designs

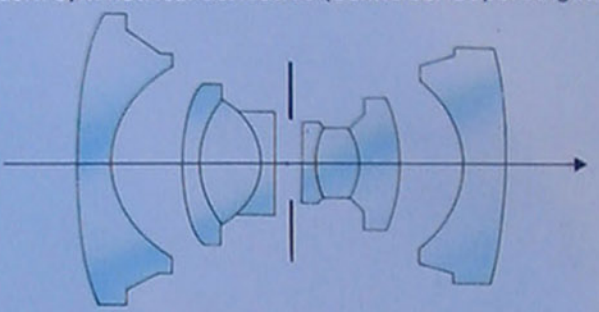
Rapid Rectilinear (1866)



Protar (1900)

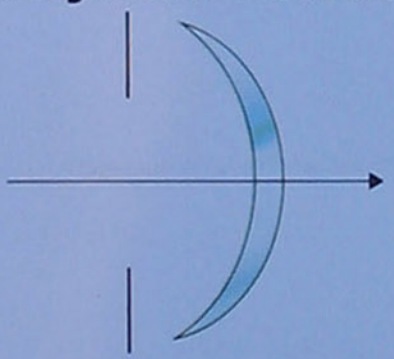


Modern symmetrical derivative (Schneider Super Angulon)

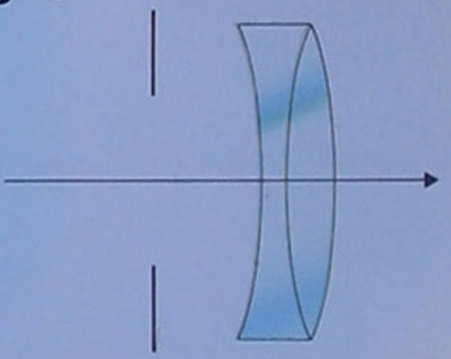


These lenses follow the same basic pattern, although they are not always precisely symmetrical

Non-symmetrical designs

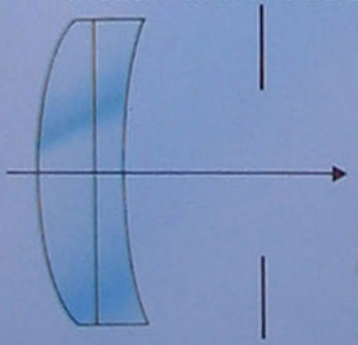


Simple meniscus lens (1812)

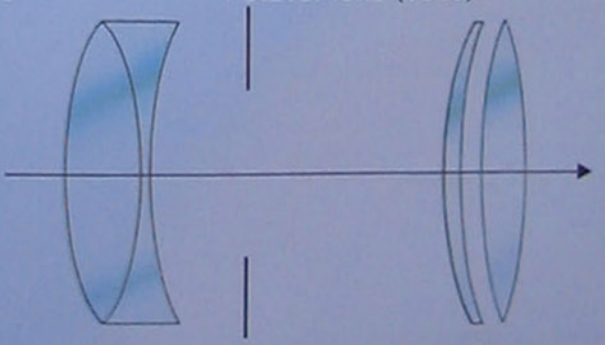


Chevalier achromatic doublet (1829)

Modern achromatic doublet



Petzval lens (1840)



Basic non-symmetrical designs, such as the achromatic doublet, are still frequently used in simple cameras, though with the stop placed behind the lens for safety

Creative approach

Aircraft

Despite the sleek machinery and the glamour of flying, photographs of aircraft, both on the ground and in the air, can be rather plain —how can you make pictures of aircraft really take off?

Walk around the perimeter of a major commercial airport or climb to the viewing platform on a sunny Sunday in summer and you are bound to meet other photographers out taking pictures of planes. While air travel is hardly the incredible novelty it was, a flight in an aircraft is still the kind of special event that many people want to record on film. Aircraft themselves are fascinating machines, and as such are very popular photographic subjects. Yet despite this, they are notoriously difficult to photograph well.

It seems natural to photograph planes when they are flying, but this presents a number of almost insurmountable technical problems—unless you are lucky enough to be able to go up in a small plane. Usually, when they are flying, planes are moving far away against a bright sky. Even with the longest telephoto, they are fairly small in the frame—it is difficult to use the longest telephoto anyway because the shot must usually be hand held. Added to this is the problem of extreme contrast between the dark underside of the plane and the bright sky. This makes it almost impossible to give an exposure that retains both detail on the plane and colour in the sky. Finally, the underside of a plane simply does not often make a very interesting shot.

With this range of problems, it is clear that it is rarely possible to photograph a plane in the air effectively and it is usually better to look for your shots

Jerry Young

elsewhere. Nevertheless, there are a few things you can do to make a shot of a plane against the sky more interesting.

In plan view, only a few planes have outlines that are sufficiently interesting to justify a shot—unless, of course, you are an aircraft enthusiast. So there is little point in shooting the plane directly overhead in silhouette. If you wait until late in the day, however, when the sun is at a very low angle, you may catch bright reflections from beneath the leading edges of the plane as it recedes into the distance which just gives the plane sufficient interest to make a shot worthwhile, particularly if there is a spectacular cloud formation. Alternatively, you can wait until the plane banks and reflects similar bright highlights.

But even for these shots, the plane must be flying fairly low—remember that even with a 400 mm lens, a massive jumbo jet just fills the frame on 35 mm when flying at only 1000 m. Usually planes only fly sufficiently low, or bank steeply, shortly after take off and before landing. So you must shoot within the vicinity of the airport. Indeed it often helps to shoot with the plane still so low that you can include the ground in the frame to act as a reference point.

Another way of adding interest to a picture of a plane in flight is to look for life in the sky, or create it artificially. Against a clear blue sky, the white trail of vapour that jets often leave behind, may lead the eye towards the plane sufficiently positively that even when it is small in the frame, the plane is the focus of attention. The colour contrast of the white line against a brilliant blue background can sometimes make an interesting, almost abstract shot. A whole pattern of crossing and curving vapour trails in the sky, produced by a formation of small jets may be even better. Some photographers put extra life in the shot by using filters to put colour in the sky artificially or fitting a fisheye lens so that the sky forms a vortex around the plane—but for this to work the plane must be very low indeed.

However, the best approach is probably to photograph planes on or near the ground. At an airport, for instance, the planes are closer and you may be able to move around to select your background and lighting. But unless you know the right people, you will almost inevitably be presented with the problem of access. In the interests of safety, security and customs, you are rarely allowed anywhere near the planes on the ground at a major airport, except when you are actually boarding the plane. Even professionals on assignment can

Jet formation *When shooting at air shows, stand well back from the crowd of spectators so that you can shoot over their heads. But even the spectacular formation flying displays by jet fighters can easily look dull unless carefully composed—remember to use the vapour trails as part of the composition.* **Beyond the setting sun** *The aircraft need not necessarily fill the frame for an effective shot—with a dramatic sky, it can be as minute as this distant silhouette—the resulting effect is almost abstract*

Jerry Young

W. Dedman/Tony Stone Associates

Jerry Young

rarely gain access to the tarmac. Remember also that many airports are 'sensitive' areas and photography may be forbidden near them. Military installations are clearly out of bounds, but so may be some civilian airports—people have been incarcerated for months for simply photographing planes. It is always worth finding out what the law is beforehand—particularly in a foreign country.

Nevertheless, runways often end fairly near the edge of the airport and if you wander around the perimeter, you may find a location where the planes take off almost over your head—it is take off that generally provides the most dramatic action shots of aircraft because the dynamic angle of the plane to the ground can inject the feeling of power and movement that is lost in the air.

For take off shots, a telephoto is usually essential: a focal length between 200 and 400 mm is ideal. With a 400 mm lens fitted, the best place to stand, if you can, is generally about 100 m from the place where the plane begins to 'rotate'—that is, where the nose starts to come up. From this position you can shoot the plane both on the runway with the nose up and as it takes off immediately over your head. It is worth watching a few planes taking off and establishing just where the rotation point is. Obviously, it will vary according to the type of plane and the weather conditions, but you can at least get a rough idea. Remember that when the wind is opposite to the prevailing direction, planes take off and land in the opposite direction. In this case, background and lighting may be totally different. Because of this, it is well worth returning a number of times until the weather is just right for the shot.

Unfortunately, even take off shots can very easily be dull unless you go out of your way to inject extra interest. These

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Glider at rest *At gliding clubs you can often move in quite close to the aircraft and a wide angle lens helps to accentuate the streamlined shape in shots along the fuselage*

Sunset strip *The outline of a plane can sometimes be more interesting than surface detail and a silhouette may be very effective*

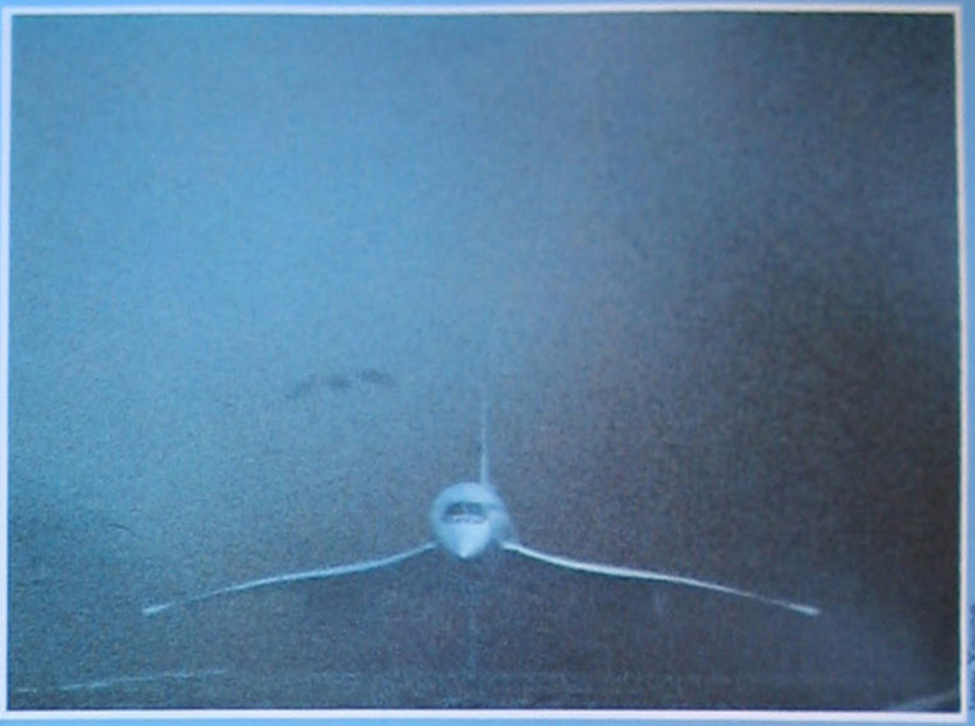
Loading check *To add variety to aircraft shots, try to include a little human interest*

Ian McKinnell

Frieze frame *The plane need form only part of a general composition. Here the modern plane is nicely framed by the ancient columns*

Blue circle *Close-ups can make strong abstract designs*

Cherville/fotogram



Jerry Young

Roslav Szaybo/Tony Stone Associates

Gloomy take-off *Use grain to create drama. Here a 2400 mm lens and push processing make Concorde loom through the mist like some great bird*

improvements need not be anything elaborate—a simple change of viewpoint may make all the difference. But dramatic lighting is usually essential—aircraft rarely look inspiring in good, clear lighting.

To capture some of the glamour of air travel, for instance, you generally need strong colours and brilliant highlights. Bright sunshine from the right angle is essential. Move around until you are shooting into the light and catch the sun glinting off the shiny metal of the engines and fuselage, creating intense highlights and deep shadows. Although you can do this nearer the middle of the day, it is probably better to shoot nearer sunrise or sunset, when the low angle sun shines along the length of the fuselage, enhancing the streamlined impression. If you can, wait for a really colourful sunset or sunrise that infuses the body of the plane with a warm, coppery glow.

Another way of creating an aura of glamour is to shoot at dusk when the runway lights are illuminated and yet there is still a little colour left in the sky. In the right circumstances you can silhouette the plane against the lingering orange glow so that little is visible but a dark shape and navigation lights. Rather than shooting with a telephoto, fit a standard lens so that you can frame the runway lights converging strongly towards the shadowy outline of the plane. Remember to use fast film, since light is poor and you need a fairly high shutter speed to freeze the movement of the plane.

Of course, air travel is not all glamour. Although the major airlines have a remarkable record for safety, many people still feel that there is something a little awesome and frightening about flying and this provides the clue to another approach. Rather than glamorizing air travel, you can try to create an air of tension. Instead of shooting only in good weather, work when the weather is so bad that the planes have all but been grounded.

In misty weather, for instance, the plane may be little but an eerie shadow looming through the mist. Move away from the end of the runway and examine the direction in which planes move as they climb away from the airport. Try and find a point where they bank steeply shortly after take off. If you can include the ground in the shot, the angle of the banking plane may help to create a feeling of instability. You can exaggerate the effect by using a very fast grainy film and shooting through a long telephoto.

Variety is essential when shooting aircraft, so once you find a few successful approaches, do not rest on your laurels: be prepared to explore alternatives. Rather than always waiting for dramatic lighting, for instance, try livening up the picture by using the background. Just

Ian Walker/Tony Stone Associates

Full frontal *The strong perspective given by a wide angle lens is ideal for close-up shots of the fuselage—especially with modern jetliners*

as in shots in the air, the sky can be enlivened by storm clouds or special effects filters, but with shots near the ground there is usually much more you can do.

Try exploiting colour contrasts between the plane and its background. A plane in the mainly red livery of TWA, British Airways and Swissair, for example, contrasts well with a blue sky, while the yellows and blues of airlines like Sudan Air and Pan American may stand out better against a dull grey sky.

In very hot weather, the vapour from the powerful engines of a large jet may create a shimmering haze over the whole background. Through a long lens, the vapour, combined with the mirage effect of hot tarmac and a few glaring highlights, may create a throbbing image of the plane thundering down the runway towards you.

Explore the area around the airport for alternative viewpoints and backgrounds. Not all the best shots are close-ups. Distant views of the planes flying over trees or houses near the airport can sometimes be surprisingly effective. It is even worth going to the official airport viewing platform. Although at first sight the platform has little to offer the creative photographer—it is too far from the planes for effective close-ups and long shots, such as the planes on the runway, are invariably spoiled by awful backgrounds—it often gives a clear, unobstructed view over the airport. With a long telephoto on a tripod you can close in on patterns created by the planes lined up against the terminal—the tailplanes or the rows of windows. At night, the planes are usually illuminated by floodlight and time exposures are very effective. The background is nicely obscured in darkness and the lurid lighting and coloured streaks from the lights of moving airport vehicles add a touch of glamour.

Spectacular events like air shows seem to have plenty of scope for the photographer, but people who take their cameras are frequently disappointed by the results. With thousands of people wandering around, many of them photographers intent on pictures rather than safety, officials often tend to be unhelpful and all the red tape usually prevents anyone, even the professionals, getting a good view of the display. Exhibits on the ground offer more photographic potential than the planes in the air. If you can get to the show very early in the morning before the crowd arrives, you may be able to get some very effective close-ups.

With many planes, full frontal shots can be very striking, particularly modern jets. But you must either frame tightly to exclude distracting background detail—there is no need to include the entire wing span in the shot—or adopt a very low viewpoint so that you can shoot up at the plane. A low viewpoint shot does not necessarily need to be close: you could move back and use lines on the tarmac to lead the eye towards the plane.

Try to vary your approach to suit the character of the plane. You can emphasise the streamlined shape of the more futuristic jets like Concorde by shooting along the length of the plane with a wide angle lens. With an old fighter plane, you could move in close and shoot upwards to achieve a dark silhouette—particularly against a stormy sky.

Jumbo jet *From the airport perimeter you can sometimes get impressive take-off shots with a telephoto. Include the ground in the frame as a reference level*

Jerry Young

Assignment

A day on a trawler

A trip aboard a fishing boat can challenge the skills of any photographer. But in return for facing all manner of physical and photographic problems, you could come away with some exciting shots

A short sea trip presents quite an unusual photographic challenge. Confined to the limited space of a boat means that the photographer has to carry out a very intensive search for subject matter while also being totally at the mercy of the elements. For this assignment, professional photographer Simon de Courcy Wheeler arranged to spend a day on a trawler fishing out of Dun Laoghoire in County Dublin, Eire. He found that the local fishermen are generally keen to allow visitors on board—as long as they do not interfere with the working activities.

However, on this particular voyage, Simon found that there was a drawback in that the trawler left harbour at 6 am

Simon de Courcy Wheeler

Wheelhouse *For a pictorial approach to the trawler, Simon combined the colours of the wheelhouse with the soft blues of the sky and sea. 18 mm lens, f/5.6 at 1/250 second.* **Network** *This subject also called for a documentary approach*

Orange mac *The bright colour of the fisherman's waterproofs proved useful for adding brightness and depth to the shots. This was the only time Simon used a 135 mm lens. (1/250 second at f/5.6.)* **Gulls** *New subject matter presented itself when hundreds of seabirds took an interest in the catch and flocked around the boat*

and returned at 7.30 pm. As it was dark at both these times he was unable to take any 'portrait' shots of the whole boat or any shots of it leaving and arriving at the harbour. By the time first light came, the trawler was way out at sea, preparing to fish for plaice and sole.

Luckily, the morning sea was calm and Simon had the advantage of good light for photographing the activities of the fishermen as well as trying to shoot some pictorial images. He found that he could get some attractive shots by combining the faded colours of the trawler with those of the sky and the sea. The fishermen themselves also provided interesting subjects and feature in many shots.

Even with a relatively calm sea the boat seemed to roll and pitch dramatically and our landbound photographer had to be careful not to slip or fall while concentrating on what he saw through his viewfinder. In addition he had to take special care to avoid the salty spray and to try not to use shutter speeds of less than 1/125 second. Although by the end of the day he had managed to prevent water coming into contact with his camera, he cleaned all his equipment thoroughly upon return.

To vary the shots Simon avoided using the same lighting all the time. Not only did he try the high contrast shot inside the wheelhouse, but he also started looking for subjects as soon as the dawn light appeared. Additional variation came from the use of backlighting but for this great care had to be taken over the exposure settings. For a silhouette effect, readings were taken from the sky, but without pointing the camera straight at the sun. To show details in the shadowed areas, on the other hand, Simon pointed his camera down at the deck to take a reading from the neutrally toned wood. This had the same effect as using a hand-held meter to make an incident light reading.

Simon found that wide angle lenses were the most useful for taking photographs on board a fairly small boat like the trawler—not only were they easy to handle while the boat rocked on the waves, but also their wide fields of view were more suited to the confined spaces. Most of these shots were taken with either an 18 mm ultra wide angle or a 28 mm 'standard' wide angle. Using Kodachrome 64 for all these shots, Simon set his Nikon FE on its manual setting and bracketed all exposures 'just to make sure'.

Simon de Courcy Wheeler

Silhouette *For his first shot, Simon used the colourful, dawn sky as backlight, behind the front section of the trawler, to produce attractive highlights (18 mm lens).* **Cleaning the nets** *The wheelhouse again featured strongly, this time in combination with the diagonal boom, to frame the main area of interest—the nets. (18 mm lens.)* **Part of the catch** *With the backlighting, Simon had to be careful to prevent his camera's meter taking a reading from the bright background (28 mm lens 1/250 second at f/8).* **Coiled rope** *The confined location meant that details were important subject matter (28 mm lens).* **Inside the cabin** *This shot was framed to show the silhouette of the fisherman, the row of windows and the patch of light on the compass. This was one of the few shots for which Simon risked a slower shutter speed—1/60*

ROSADIEHINN

Neil Leifer

In a career spanning two decades, Neil Leifer has made a name for himself as one of the greatest sports photographers in the world. He is now a leading photojournalist working for *Time* magazine

Professional photography can be tough and competitive and, to get on, photographers must usually specialize in a particular field, whether it be advertising or fashion, photojournalism or portraiture. And a photographer who succeeds in one field can rarely move to another with equal success. Yet once already Neil Leifer has done just this and he may well do it again.

For 17 years, between 1961 and 1978, Leifer worked for the prestigious American magazine *Sports Illustrated*. During these years, he earned himself a reputation as one of the world's top sports photographers, a man with a remarkable eye for dynamic action shots and a knack for being in the right place at the right time. Yet in 1978, when his career as a sports photographer was at its peak, he joined the staff of *Time* magazine as a photojournalist.

Despite the obvious and significant differences in approach and subject matter between sports photography and photojournalism, Leifer has now firmly established himself as a photojournalist, and although occasionally he is asked to do a sports assignment, there is no doubt that photojournalism is now his main source of inspiration and income. But he has begun to make films!

Neil Leifer/Sports Illustrated © Time Inc./Colorific

Weight lifting champion *Vassily Alexeev winning the European Championships in 1970. 85 mm lens and strobe lighting.*
Steve Cauthen *the US boy-wonder jockey displaying the smile of success*

Leifer grew up in Manhattan's Lower East Side, one of the humbler areas of New York City. Like many boys, young Neil was a sports fanatic, not only participating but keenly following the progress of the professionals. But he was also a budding photographer and soon began to take his camera along with him to sports events. Then he was just a kid with a camera who took pictures of his favourite activity—sports. But after he finished high school he decided to try to sell his pictures.

Naturally, at this stage in his career, he had neither the equipment nor the 'privileged' viewpoints of the professionals at big sports events. But he turned these apparent disadvantages to positive assets. At the time, many press photographers still used bulky cameras

like the Speed Graphic and sat in special press galleries—although a few, such as Mark Kauffman and John Zimmerman, were beginning to exploit the potential of 35 mm. What Leifer did was to shoot the event from the stands using SLRs with telephotos. The photographs had the excitement and action that most of the press photographs lacked. Some of the professionals were naturally resentful.

Leifer determinedly took his pictures round the magazines over and over again until they began to be accepted. And gradually the picture editors began to notice that he was bringing in the dramatic action shots that their own photographers were missing.

By mid 1961, aged 19, Leifer was working almost exclusively for *Sports Illustrated*. Since then, he has covered most of the world's outstanding sports events. These have included eight Olympic Games, 15 Kentucky Derby horse races, almost every one of the World Series baseball games and every important heavyweight fight.

His photo essays have also covered most sports from ice-boating and basketball to weightlifting and skiing. He still loves sports. As he says, 'I don't think you can go to as many football games as I've photographed, or see as many fights as I have if you don't like it. At first it was like a big joke to me that somebody would pay me to go to football and baseball games . . . to do things that I like.'

Now he is a photojournalist, he gets a similar kick from being on the spot as news is made. He knows that if he was not a photographer he would be 'glued' to the television watching the live coverage. It is an aspect of photography that never ceases to amaze him. 'I'm not blasé about these things and I don't think I ever will be. I am tremendously excited by seeing events happen.'

Unlike many professionals, he has never got bored with his job and continues to pour in creative energy. Leifer will go to extraordinary lengths to take unusual pictures. When photographing the start of the Boston marathon once, for instance, he hired a cherry picker truck crane and positioned himself over the road 200 m from the starting line so that he could get a superb aerial view of the hundreds of competitors.

Sometimes he uses ideas that he started working on years before, like the portrait taken for *Time* of the American football coach, Bear Bryant. The picture is a double exposure which combines a portrait of Bryant with a series of drawings of football moves made on glass. One of Bryant's hands is raised as if in the act of drawing the plays.

He had produced similar pictures before, but with Bryant, the idea worked most strongly. 'Every time I took the picture, it got a little bit better. And finally, not only did it get better, but I got it on the cover of the magazine. I took all the expected shots of Bryant on the football field, coaching the team, and then I remembered that I had had this idea for a double exposure of an athlete or a coach with some plays (moves in football) 15 years before, and I tried it with Bryant. All the technical details had

High dive *This shot of America's Micki King at the 1972 Olympics. 35 mm lens on a Hulcher sequence camera.* **USC football team** *in 1972. Taken by remote control using a fisheye lens for 'Sports Illustrated'*

finally been solved and also, editorially, it fitted the subject.'

Leifer has always been adept at finding a different and revealing aspect of a sports event. In an essay on ice-boating for *Sports Illustrated*, for instance, he installed a remote controlled camera to the top of the boat's mast. The skipper of the boat helpfully released the shutter for him. But not content simply to cover the race from the sidelines, Leifer took his other shots from the bow of another boat, racing along at 210 km/h in the icy wind.

In such conditions Leifer has to know exactly which lens he wants to use in advance because he can never change it later. Leifer has a complete range of lenses out of which he most frequently uses the 24 mm, 50 mm, 105 mm, 180 mm, 300 mm, 400 mm and 600 mm. He uses Nikon cameras with motor drives. Even though he covers many non-sports events now, he continues to use his motor drives as he is so used to them.

It is this capacity for the unusual that has kept Leifer near the top of his profession for so long. When selected to cover a story, Leifer is generally given a very specific brief, particularly if it is for the cover of the magazine. His picture editor, the editor of the magazine, and the art director responsible for the cover, often suggest precisely what they want him to photograph—even going so far as to make a sketch of how they would like it composed.

'Your first obligation is to give your editor what he's asked for. You can never come back without that. Your second obligation is to give him something better than what he asked for, if you can.'

When Steve Cauthen, a 16 year old jockey had just burst into the top of the racing field, Leifer was asked to do a cover picture for *Time*. Leifer brought the editors the requested picture of young Cauthen on one of his winning mounts. But he also went further. He brought back a studio portrait of the teenager in his racing silks smoking a cigar and sporting a big, confident grin. It was a gesture that was symbolic both of victory and of a teenager's emulation of adulthood. It made the cover.

For an outsider, it is enlightening to discover that the studio plays a regular part in his location work. Whenever he can, he arranges some sort of studio on his assignments, no matter where he is. This may be a hotel room or locker room—anywhere where he can put up seamless paper and some lights. In this situation he usually uses a Hasselblad with a 150 mm lens. While the action usually takes place outside, studio shots can sometimes be an effective addition.

Surprisingly, perhaps, for a sports photographer, Neil Leifer is remarkably adept at handling lighting. To many people it seems that he would work largely by available light, but indoor sports often call for elaborate lighting set-ups and this is something Leifer excells at. He once arranged 40 electronic flash units to supplement the lighting already provided in the arena for a boxing match. While Leifer covered the action from the ring-side, his assistant tripped the shutter for an overhead camera, which Leifer had installed prior to the fight. The result of all this staging was one of the most dramatic shots in boxing history. It shows Muhammad Ali's victory over Sonny Liston after one of the world's most memorable fights.

It is to this kind of detailed planning and thought that Leifer owes his success. Clearly luck plays a part but, as he says, 'the difference between a really good photographer and one who is not is that when the really good ones get lucky, they don't miss.'

Nevertheless, to take consistently outstanding shots, a photographer must often take chances and risk losing a good standard shot to get in the right place for the unusual, dramatic shot. On an assignment for *Time* covering the Republican convention in 1980, Leifer took a photograph of Ronald Reagan and George Bush smiling with their arms raised in victory after winning the Republican nomination. In order to get it Leifer gambled on the fact that the victors would turn around and face backwards away from the crowd as they often do. Fortunately, the two were also close enough together to fit on to the format of a cover picture and they were both

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waving. Even with this kind of luck it is still a situation you have to cover quickly as Leifer explains. 'Reagan and Bush didn't stand there for long. When something like this happens, you have to make sure you get it.' The shot was a front cover on *Time* magazine.

Of course, there have also been times when Leifer has not had much luck. Although boxing is his favourite sport he considers it one of the most difficult sports to photograph because the action is so unpredictable.' When Joe Frazier fought Muhammed Ali in Madison Square Garden, for 14 rounds, I did everything right. I had a very good night: I was choosing the right lenses at the right time. And then Frazier knocked Ali down, which was the story of the whole fight. First, it happened in the wrong corner of the ring for me, and second, I was using a long lens at the time. Consequently, no picture, certainly no good picture. But I had done nothing wrong.'

At *Time* magazine Leifer is still assigned sports stories. As he agrees, 'They would be foolish not to take advantage of my background.' But he only does such a story when it is a major sports essay. Nowadays he would rather do a minor political story than many major sports assignments.

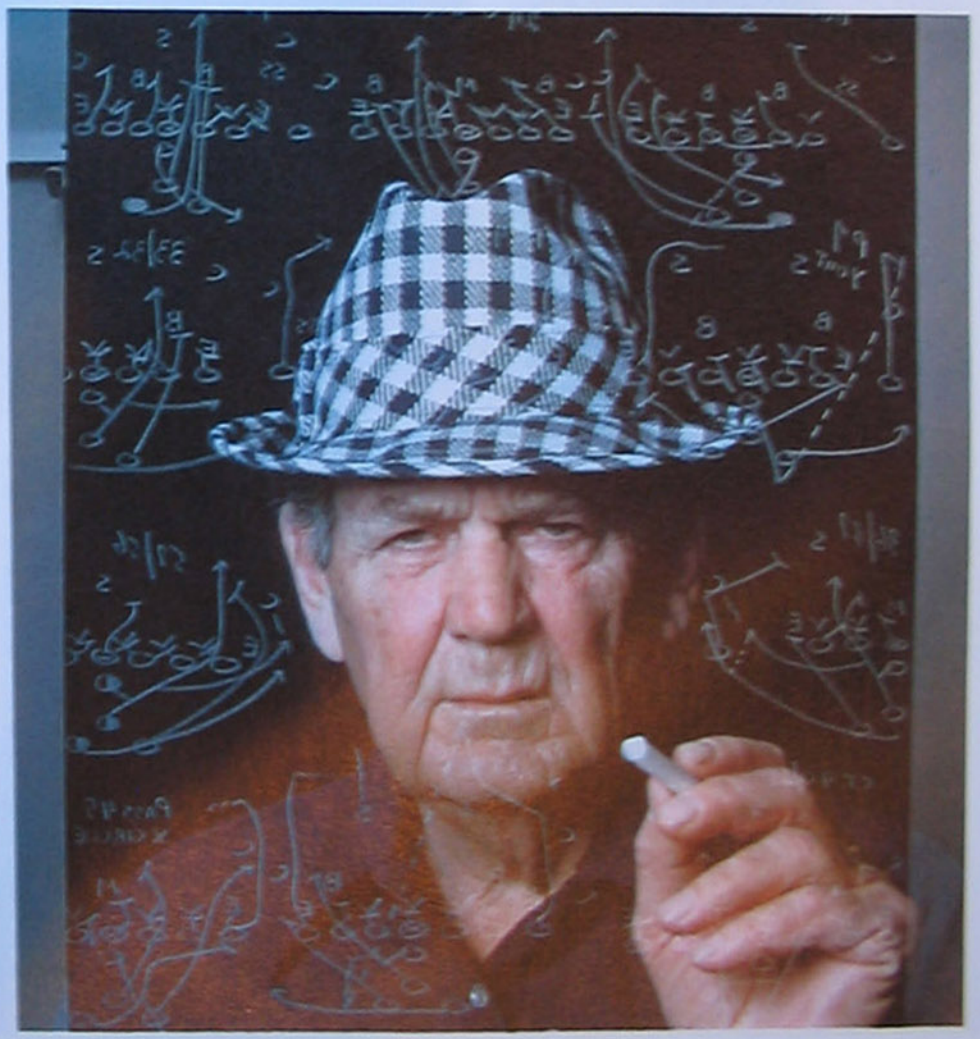
Of the many political stories he has taken for *Time*, Leifer cites one for special mention. This was an essay on the flamboyant and often controversial Mayor of New York, Ed Koch. For Leifer the story was a chance to spend time with someone he greatly admired. As he says he had 'a marvellous subject doing a fascinating job.' On one of Leifer's office walls he now has a print of a picture of Mr Ed Koch. The mayor signed it, 'To Neil Leifer, an extraordinary photographer who has become a good friend.'

Another favourite assignment was a story on the country music performer Willie Nelson. He had to watch nearly seven performances to do an all-round coverage of the player's work and life. 'Photographing Nelson was very similar to covering sports. Here's a guy who jumps around stage with a mircophone and sings. The lighting was the same as lighting a prize ring.'

Besides the variety of different stories that Leifer gets to do for *Time*, he also enjoys the facilities he has there. Its many departments take care of all his needs—from making travel arrangements to supplying film, equipment and

Neil Leifer/Sports Illustrated © Time Inc./Colorific

Knockouts *Cassius Clay (Muhammad Ali) beating Sonny Liston (above) in 1965 and Cleveland Williams (left) in world championship fights. Lit with strobe lighting. The overhead shot was taken by remote control on a motorized Hasselblad and 50 mm lens.* **Bear Bryant** *(right), the American football coach planning moves*



assistants. 'It's a perfect situation because I don't have to leave the building other than to do the assignment.'

In spite of his obvious enjoyment of photography Neil Leifer's future probably lies in film-making. In 1979 he directed *Yesterday's Hero*, a feature film based on a Jackie Collins novel. He sees this as a natural progression from his photography. 'A large part of my success as a photographer has been my ability to motivate people to do things for me and to get things done. Film is exactly that, and I'm very turned on by it. With film, you start with nothing: you create everything. It's very exciting and also it's working with people.'

Leifer's progression from sports to journalism to film may not seem very logical to anyone else. But to Leifer, whose favourite subject has always been a camera, and whose motivation and attention have always been concentrated on ideas, it seems to make perfect sense. With his ability to find good situations and then capitalize on them, film-making is just another way of making use of his talent.

Processing on location

If you want to check your equipment while on holiday, by seeing samples of your photographs before you return, you can use some simple techniques for processing films without having to use a darkroom

For the majority of darkroom processes, some sort of darkroom and an array of often elaborate equipment and chemicals are essential. So when most photographers go out for the day or away for a few weeks on holiday, they wait until they return home before processing pictures. Yet if you need the pictures immediately, or if you wish to check that your film and equipment are working properly, you can develop films on the spot with special processing techniques. This is particularly important if, for example, you have taken an untried camera away with you.

The amount of equipment you need to take with you and the complexity of the process depends on the quality of results you aim for. If you only wish to develop a roll of film in order to check for faults—such as fogging by airport X-rays or bad flash synchronization—you can use a simple *monobath* process, and to make things even simpler you can process the film in its own cassette.

Monobath processing

Unlike normal processing techniques, a monobath combines developer and fixer in one solution. Monobath chemicals are often difficult to buy—although Tetenal produce a ready-made monobath called Monotenal which is ideal for slow and medium speed films—and you may have to mix your own chemicals (see panel). But monobath processing is ideal for getting quick results.

The advantage of a monobath is that you need virtually no special equipment. All you need, besides the chemicals, is a supply of running water and a clean cup. With a monobath, the contrast and density of the negative are controlled by the ingredients of the solution rather than by time or temperature. So you need to take neither thermometer nor timer. The film does not have to be transferred to a developing tank for processing—it can be processed in the film's own cassette in broad daylight.

Processing in a cassette is simple. Start by rewinding the exposed film in your camera carefully so that the end of the film protrudes from the cassette when the film is removed from the camera. Tape the film end to the side of the cassette so that the film cannot be drawn into the cassette when the cassette spindle is turned during agitation.

Cut a notch into the end of a pencil or a suitable piece of stick so that the stick can be fitted over the end of the cassette spindle. Fit the stick to the cassette spindle and completely tighten the film by turning the stick. Then turn the stick in the opposite direction until it can be turned no further, carefully counting the number of turns. When the film is processed in a monobath, it is agitated by twisting the cassette spindle back and forth for the appropriate number of turns while the entire cassette with the film inside is immersed in the monobath solution. To minimize the risk of scratching the film during agitation, you should use a 20 exposure rather than a 36 exposure film, and you should not wind and rewind the film completely.

To process the film, tape the cassette very securely to the inside of a suitable cup or bowl—it must not become detached during agitation—and pour in some of the monobath solution. Alternatively, hold the cassette in place but do wear rubber gloves. The cassette should be completely submerged in the monobath solution. Try to avoid letting the solution come into contact with your skin, since monobaths are usually more strongly alkaline than normal developers.

With most monobaths, processing is complete within five to ten minutes. The cassette can then be opened and the film washed and dried normally. Once the film is dry, you can examine it for faults.

Unfortunately, although monobath processing is very simple and practical, it does not give highest quality results. Monobaths are usually formulated to work best with a particular type of film, such as slow or fast film, but even with this, monobath processing rarely produces results that are as sharp or as fine-grained as those given by conventional development and fixing. If you want high

Robinson/Brown

Neatly packed *Much of the equipment you need to process film can easily be packed into your luggage*

quality results, therefore, you must resort to more conventional processing techniques.

Conventional processing

Although conventional processes give better results, they are far more difficult to operate out of the darkroom. You need a considerable amount of equipment because both timing and temperature

Dave King

Changing bag *If you are unfamiliar with changing bags, practise a few 'dry' loading attempts first*

are important factors.

First of all, you need a suitable developing tank and spiral. The best choice is a tank made of resilient plastic which is light and reasonably resistant to damage. Avoid the plastic tanks that are inflexible and brittle and may be broken in transit. Stainless steel tanks are heavier than plastic tanks and if one is dented it may be impossible to fit or remove the tank lid.

A thermometer is also essential for accurate temperature control. Glass thermometers are usually too fragile for travelling, unless they have a sturdy protective case. A protective robust thermometer, such as a stainless steel dial type, or a digital electronic thermometer, is a better choice. A watch with a secondhand, or a digital type, is adequate for timing most processes.

Because you need to load the film into the developing tank in total darkness, you also need some form of blackout. Perhaps the simplest and most efficient is a changing bag. This is a bag in which the developing tank, film and scissors are placed and sealed in by a pair of zip fasteners. It has two hand-holes through which you manoeuvre the film into the tank. When your hands are inserted into the tight fitting bag sleeves, the interior of the bag becomes light-tight and you can proceed to load the developing tank. Most changing bags are made of a double thickness of opaque rubberized fabric with a pair of elasticated sleeves. If you are used to loading developing tanks at home in a darkroom, you may find using a changing bag difficult at first but the technique is easily mastered. It is best to buy as large a changing bag as you can afford so as to make manipulation as easy as possible.

If you do not have a changing bag you may be able to improvise a substitute by working under as many layers of heavy coats and blankets as you can find. This is much more risky than using a proper changing bag since light often leaks around the edges of piles of blankets, but you can reduce the danger of fogging your film by working at night in a darkened room. Many modern hotels are built with windowless bathrooms that can easily be blacked out completely by blocking up cracks with towels and blankets.

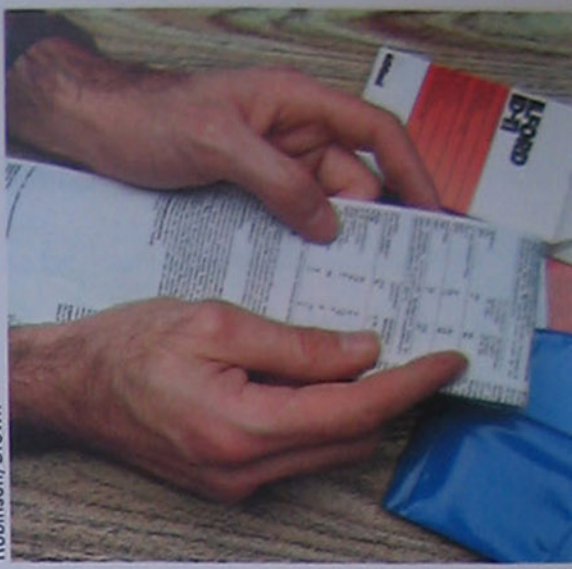
Maintaining proper solution temperatures may also be difficult. If you are working in a very hot climate the water in the taps may be at a higher temperature than the standard 20°C used for most processing. In such a case, you may need to do your processing at night when temperatures are lower. Most developer manufacturers produce time-temperature charts that tell you the adjustment to processing times needed for abnormal temperatures, and it is rare to find water supplies are too hot to fall within the range of such charts.

Disposable plastic cups are useful for holding premeasured quantities of chemicals. The cups can be placed in a bowl of water to bring them to the correct processing temperature.

The water you use for mixing chemicals may contain impurities, even in advanced countries. Before you dilute any of your solutions, examine the local water carefully for any suspended particles or other visible impurities. If you find any, you should filter the water before use—even a simple coffee filter will do. This is a time consuming process, but one that can greatly reduce the number of spots on your negatives. Be sure to filter your wash water as well as the water you use for diluting chemicals.

Beware of customs *Unlabelled, unboxed packets of whitish powder invite suspicion, so take liquid chemicals*

Robinson/Brown



Robinson/Brown

Temperature variations *You can find times for non-standard processing temperatures by consulting the sheet of developer instructions*

Areas that have unusually hard water supplies—water containing much dissolved limestone—may produce negatives with a lot of surface scum after drying. The remedy for this is to use a wetting agent and to wipe the film down carefully with a clean well wetted sponge before drying.

When the shortest possible processing times are needed, proprietary drying agents can be useful. Tetenal Drysonal, which is also marketed as Beseler

Daylight loading *To save all the fuss and bother of loading a conventional tank in darkness, consider taking a daylight loading tank with you*

Robinson/Brown

Ultradry in some parts of the world, is a volatile liquid that rapidly evaporates from film when it is hung up to dry. A film that has been soaked in drying agent usually dries completely within five minutes.

Although results from conventional processing away from home are better than with the monobath, they are still likely to be slightly inferior to those you can achieve in a permanent darkroom at home. You should avoid processing film on location unless you really have to. Before resorting to doing your own processing, make sure that you have explored all the available alternatives. If you have some colour slide film that you need to have processed quickly while you are abroad, for instance, it is much more sensible to seek out a local professional photographer and ask him where he has his film processed than it is to attempt to process the film in a hotel room or a tent. Regard processing away from home as a useful emergency measure, or a test to ensure that everything is working properly, and keep the films containing important pictures until you get home so that they can be given the processing they deserve.

In-cassette processing

A monobath is ideal for in-cassette processing. You can make your own with either of these formulae, depending on the availability of chemicals, or buy it ready-made.

	A	B
Warm water	750 ml	750 ml
Sodium sulphite (anhydrous)	60 g	50 g
Potassium alum	——	18 g
Hydroquinone	30 g	15 g
'Phenidone'	3 g	10 g
Sodium hydroxide	25 g	18 g
Sodium thiosulphate (crystalline)	150 g	60 g
Add cool water to make	1000 ml	1000 ml

With formula A, add 10 ml of standard 40 per cent formaldehyde immediately before use. With both formulae, development time is between 4 and 8 minutes at 20°C—allow longer if cooler.

1 *When processing a film in its cassette, first ensure that the leader is not wound back into the cassette*

2 *Trim and tape the end of the leader to the cassette itself, using suitable waterproof tape*

3 *Cut a notch in the end of a pencil and use it to tighten the film. Then count the turns required to loosen it*

4 *Pour in enough monobath to submerge the cassette completely. Note how the cassette is taped to the glass here*

5 *For agitation, twiddle the notched pencil one way, then the other, for the number of turns you have counted*

Robinson/Brown

6 *After between five and ten minutes processing is complete and you can carefully unspool the film for washing*

7 *Dry the film in a dust- and draught-free place, hanging the film with clothes pegs or drawing pins*

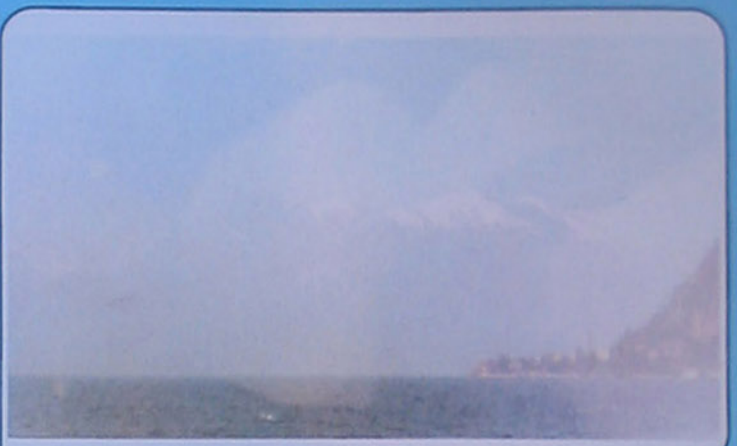
8 *If you have to adjust the temperature of non-monobath chemicals, use a cleaned sink as a waterbath*

What went wrong?

Pictures on the move

When shooting from a moving vehicle, things often happen so fast that 'grabbing' a good shot is difficult. However, by watching certain points you can ensure that your results are at least satisfactory

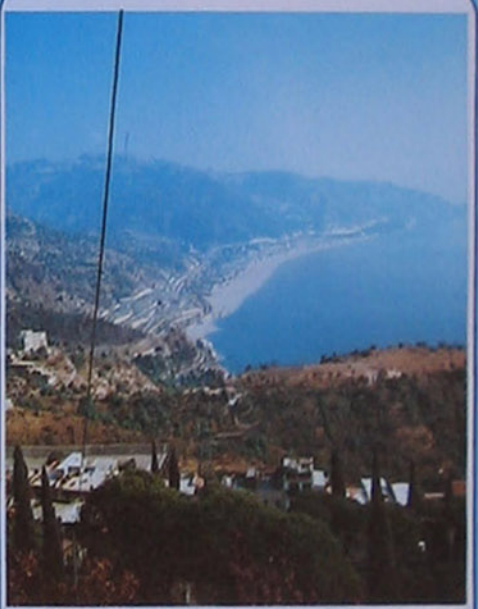
When inside a moving vehicle, remember that low light may require a slow shutter speed. By using flash, you avoid blur from camera shake, and the colour cast from artificial light



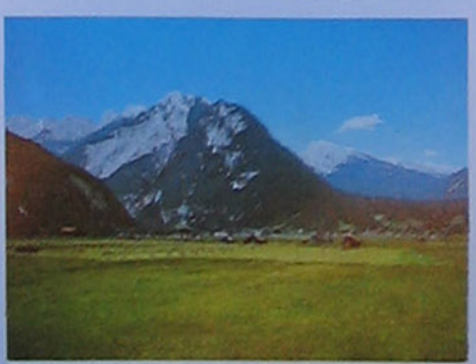
Vehicles' windows reflect strongly. If you cannot open a window, hold the camera close to the glass

If you are travelling by train, pylons can be a problem. To avoid them, note the spacing between them and shoot after passing one

Vegetation by the roadside or the railway can hide subjects, but all you can do is to try to raise your viewpoint



This shot from a cable car shows the cable, which is distracting so watch out for extraneous elements spoiling the view



The relatively slow shutter speed (left) has resulted in a blurred foreground. If you cannot exclude the foreground by changing the composition, try using the fastest shutter speed you can (centre) to reduce blur to a minimum. When movement is too fast to freeze in this way, point the camera at an angle either forwards or backwards. Angled movement like this is easier to freeze (right)

Making a feature film

Technical advances and an increasingly sophisticated audience mean that even simple feature films require a vast army of individual specialists and technicians behind the scenes

Imagine a deserted sandy beach at dawn. Out of the morning mist loom large vehicles carrying technicians who proceed to transform the landscape with palm trees, tropical plants and a prefabricated palm thatch hut. More trucks arrive unloading arc lights and other strange pieces of equipment. Everything is laid out to a master plan. Finally come the rest of the technicians and the actors who are going to start filming on the now transformed 'tropical beach'. A movie crew is on location.

The popular image of film making is of huge sets, with directors yelling 'action' or 'cut' at appropriate moments. Yet the filming is only one part of the actual work, and is condensed into just a few weeks of what may be a year-long schedule. Even with the technical advances which have revolutionized film making, it is still a very long and involved process.

The work of making a major feature film divides into three segments. During *preproduction* a story is developed from an idea to a shooting script and the logistics of converting this script into pictures are worked out. The *production* period—when the story is actually put on film—is usually the shortest and the most expensive period. Artistes, crew and facilities have been contracted and must be used fully and economically.

Once the main photography is complete the *postproduction* period begins. The *rough cut* version of the film which has been assembled during shooting is edited. During the production and post-production period all the elements of the film are gradually added—including the special effects, the second unit filming and the sound track.

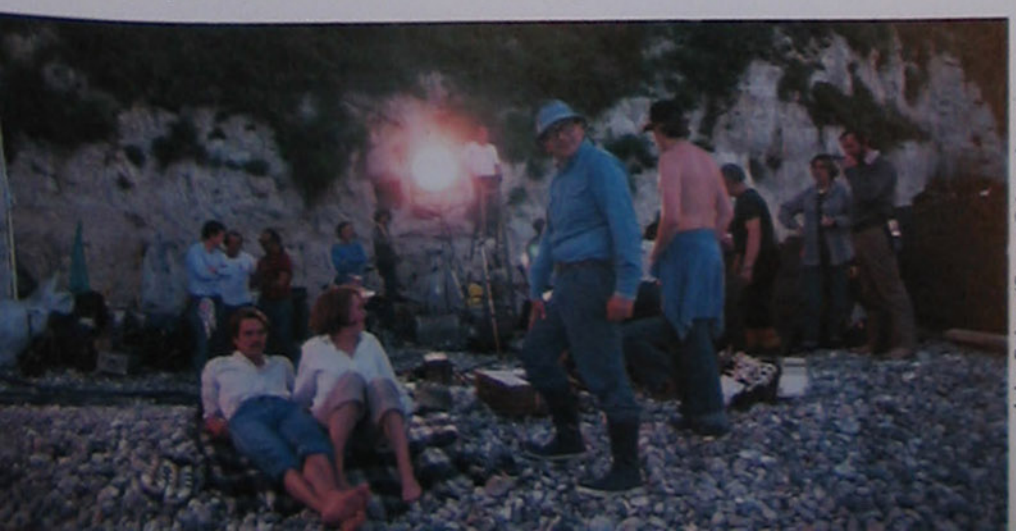
Music is then composed and recorded, together with sound effects tracks for the background atmosphere. Finally all these tracks are combined in a complex recording session in a *dubbing theatre* to form the final sound track. Titles and optical effects are added, and the fine cut of the film is made and finally approved for release.

The amount of time required to produce a film naturally depends on the subject and the scale of the production. As examples a *James Bond* or *Superman*-type film may require a year or two from the time the shooting script is available until the film is delivered for release. Such elaborate stories must be shot both in a studio and on various locations in many parts of the world—often with several units shooting at the same time.

A production unit can only operate well and efficiently as a team. The person who has overall responsibility for the practical and financial aspects of the film is the *producer*. The *director* has

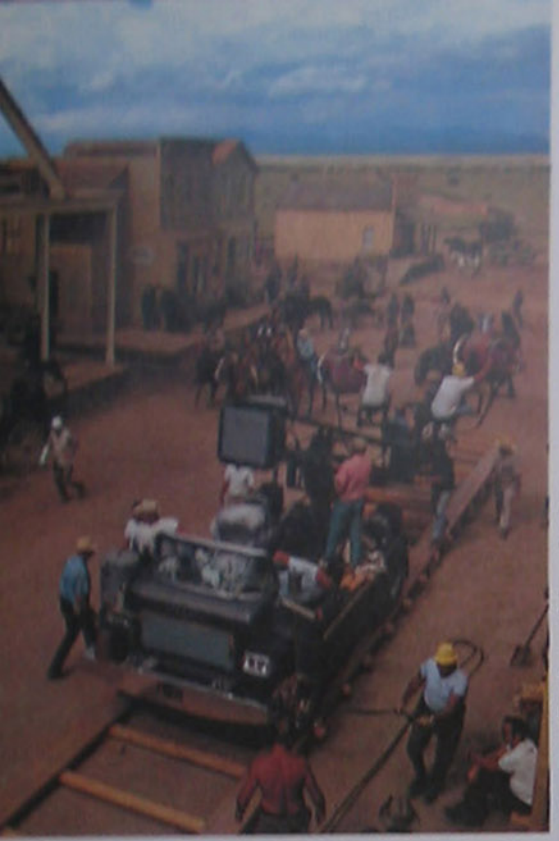
David Farrell

Getting ready to film *The clapper boy marks the beginning of another 'take' in the filming of 'Lion of the Desert'. The small lamp in front of the camera is used to fill in the shadows produced by the strong sunlight*



John Bulmer/Susan Griggs Agency

On location *Jeremy Irons, Meryl Streep and the director, Karel Reisz, during filming on 'The French Lieutenent's Woman' surrounded by the paraphernalia of filming, including a large reflector screen and a 'brute'*



Adam Woolfitt/Susan Griggs Agency

Using a motorized crane *on the outdoor set constructed for the making of 'Cheyenne Social Club'. The arm is raised and lowered hydraulically, and the truck runs along a wooden track to minimize shake. Here the 'brutes' are also mounted on the truck*

artistic control and is responsible for the creative translation of script to film. In the initial stages he or she usually works very closely with the *writer* and the producer. As the project progresses the cameraman, production supervisor and other department heads become involved in the planning of the production. The unit shooting schedules are prepared, sets designed and locations selected.

Until the early 1960s almost all feature films were largely shot in studios on built sets which were sometimes very elaborate and required large departments of carpenters, plasterers, electricians and other specialized craftsmen. Location shooting, with all the problems of uncertain weather and the sheer bulk of the available equipment was usually only resorted to where absolutely essential. A number of technical advances—in sound recording, film stocks, cameras, lenses and lighting—liberated film crews to a large extent.

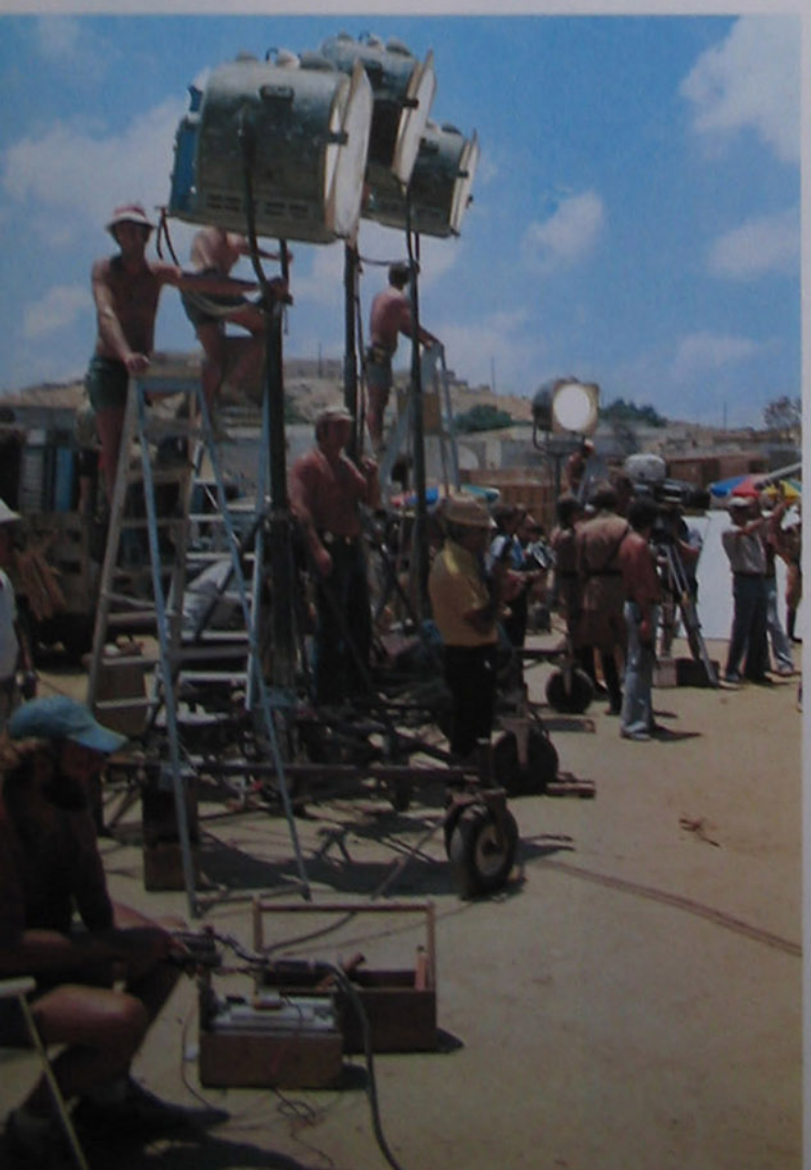
One of the major revolutions was in sound recording. From the early days of talkies, sound was recorded on film using an *optical track*, whose visual appearance changed with the sound frequencies. This system is still used when projecting the film to an audience. But with the advent of magnetic recording, it was possible to dispense with the large truck required to carry the optical recording equipment. Sound is now recorded on a portable reel-to-reel machine using standard 6 mm tape at 19 cm/sec recording speed.

Another revolution was in the colour film stock used in the camera. From the mid 1930s the majority of films shot in colour were made using the Technicolor process. This required a special camera that simultaneously exposed three 35 mm film negative rolls to produce images of the red, green and blue light components of the shot. Needless to say such a machine was practically elephantine and it required the full-time attentions of two Technicolor technicians as its guardians.

This camera joined the ranks of the dinosaurs when negative film stock became available, the same colour negative film used in still cameras today. A positive print—in movie terms, a positive film print—would be made for projection purposes. A commonly used stock is Eastman Color Negative Type 5247 (see page 1043). Modern films also have finer grain for their speed than earlier ones. The film is manufactured to be balanced for exposure to tungsten light, but if the shooting is on location, colour correction filters will be used on the camera. Though it is possible to make corrections during printing, the aim is to get as perfect a negative as possible.

Cameras, too, have been improved. The modern studio camera, though still enormous by home movie standards, is both much lighter than earlier models and is virtually silent.

Zoom lenses are now commonplace, though the zoom shot is less often used in feature films than in TV films or documentaries. A good quality zoom is often used as a fixed lens of variable focal length, without using its zoom capabilities. Typical are the Cooke Varatol lenses, which have a range of 20 to 100 mm and 25 to 250 mm and wide apertures. Movie lenses are calibrated in T-stops, rather than f-stops, however. This means that the stops are marked so that one stop is an accurately measured change in light intensity by a factor of two (see pages 1330 to 1331). These



David Farrell

Remote control *was used to set off special effects when filming a battle scene in 'Lion of the Desert' on location*

Midnight Cowboy *A camera was mounted inside the coach to add realism to the closing sequence of this film*

Kobal Collection

R.T.E./Joe Dunton Cameras Ltd.

lenses are, strictly speaking, variable focal length rather than true zooms—they must be refocused at each new focal length, except when set on infinity.

Along with improvements in film and lenses, lighting has also been revolutionized. In the days of the Technicolor three strip camera, the high level light intensities which it needed could only be provided by carbon arc lamps which burnt carbon electrodes at a prodigious and expensive rate. The biggest of the units was a 30 kw *brute*—as all such large lamp units are known. On some sets as many as 40 brutes plus dozens of smaller arcs could send the temperature up to and beyond 40°C. On location, each brute needed four men to handle it because of its weight, and only four lamps could be run from a single mobile generator.

While 30 kw arc brutes are still used from time to time, the advent of faster film has meant that less light is needed on a set. And the modern quartz-halogen lamps are much smaller, providing high light intensities with only small generators or, on location in a building, operated directly from the mains supply.

With all these benefits, producers and directors can now take advantage of locations which had previously been impractical. Film units can now shoot films entirely on location.

The choice of whether a scene, or indeed the whole film, is to be shot in a studio or on location depends on a number of factors. Studio shooting is more expensive but more controllable, and is usually preferred for interiors. Location shooting is essential where particular scenery is required, and is cheaper as long as the location does not need extensive modification. Where modern locations are needed, for a screenplay set in the present era, streets and even ordinary rooms can be used. Unless the room is quite large, however, there is a danger that the sound will become 'boxy' and that lighting and camera angles will be restricted. Low budget movies, and those where technical quality can be sacrificed for authenticity, are often made entirely on location.

A surprising number of interiors and even exteriors, however, are studio sets, usually undetectable from the real thing on film. For *All the Presidents Men*, a movie in which much of the action took place in the offices of the *Washington Post* newspaper, the entire newsroom was re-created in a studio, complete with strip lights in the ceiling. For a *Superman* film, a complete American street several blocks long was built on a British studio lot, complete with buildings and four lanes of traffic.

While such sets seem elaborate and expensive, they need only be seen from restricted angles and are simply facades. The skilled construction craftsmen make extensive use of vacuum pressed sheets, which are easily cut and sculptured, to fashion elaborate sets which would once have taken an impractically long time to produce.

The sets are designed early in the preproduction period. Once the shooting script has been established, the *production designer* creates the designs for the sets in which the action takes place. Sketches of how each shot will appear are made, and other people such as a set decorator, construction manager and craftsmen become involved in turning the sketches into actual sets.

The shooting itself generally takes place out of sequence for several reasons. A particular set may be seen at different points in the final film, but it is logical to film all the events on that set together. Another constraint is that a particular leading actor may only be available for a short period, so all his scenes must be shot together.

To film dialogue with individual shots of both actors, a sequence is filmed at least twice, with the camera focused on each actor in turn. The shots are edited together later to make a continuous dialogue sequence. On some occasions

Cameras on location *The modern 35 mm camera is much quieter and lighter than earlier models. Typically it weighs 22 kg and has spools carrying 305 m of film—enough for 11 minutes shooting. Because of its high quality results it is used whenever possible. During shooting for 'The Eye of the Needle' (right) it was carried out to a small rocky outcrop. Some, like the Panaflex, can even be hand-held, particularly with the revolutionary Steadicam stabilizing system—being used (above) during filming on the Irish TV production 'The Year of the French'. The camera being used at Shepperton Studios during the filming of 'Brimstone and Treacle' (below) is mounted on a dolly which is hydraulically operated to allow the camera to move smoothly and very easily in any direction. It is being operated by the camera operator and focus puller. The director of photography can be seen here taking a light reading in the corner of the set*

David Farrell/United Artists

David Farrell/'Brimstone and Treacle'

David Farrell/'Brimstone and Treacle'

In the studio *Behind the scenes on one of the studio sets for 'Brimstone and Treacle'. Shooting is taking place behind the windows on the right. Hoses provide rain effects when used together with the autumn leaves and the wind machine seen to the right. The scenery is a painted backdrop. Some large studios also have tanks where water scenes can be simulated*

A storm scene *from 'The Eye of the Needle' is being filmed here (below), using a giant wind machine and heavy duty hoses. A small fishing vessel was transported to the studio for use in these scenes. Alternative camera positions have been constructed on either side of the boat*

one actor may not even be present when the other is being filmed.

Such techniques demand good continuity, so that there are no glaring differences between subsequent shots which may have been filmed separately. The *continuity* person—known in the US as the *script clerk*—works closely with the director and keeps copious notes and possibly Polaroid prints of all details. For example, a script may call for a day exterior of a country house with two people arriving by car and entering the front door. This would be shot on location and it may have been raining at the time. Other shots of the house exterior later in the script would probably be filmed on the same day, and the next scene in the film, in the entrance hall of the house, may not actually be scheduled until some days later. The continuity notes will show in which order the artistes should walk through the door, with which hand the door was opened, whether coats and hats were worn, buttoned or not, how wet they were and so on.

The shooting itself is planned as much as possible beforehand, even down to the way each shot will appear in general. The person responsible for creating the director's visual interpretation of the story is the *lighting cameraman*, also known as the *director of photography*. The camera crew includes the *camera operator* who is responsible for all camera movements, framing and composing each shot to the director's requirements.

The camera operator is assisted by the focus puller, whose job is to measure the exact distance of each shot and control the focus, zoom and aperture setting of the lens. A complicated zoom shot may require the help of an additional person to maintain the focus as the lens is zoomed. A further camera assistant, known as the *clapper loader*, is in charge of all film stock and loads each day's requirements into magazines. He also keeps detailed records of each shot so he can give instructions to the film laboratory and information to the film editor. The *camera grip* is the person who operates the *dolly* on which the camera is mounted.

The camera is mounted on the jib arm of the dolly which is hydraulically operated enabling it to be raised and lowered very smoothly from about half a metre above floor level up to about 2 m. The wheels of the dolly enable it to travel along or *track* and they can also be rotated in the horizontal plane to allow a sideways or crab motion to follow the action. For location use there are lightweight versions running on tubular tracks. For shots demanding greater heights and more speed, cameras are operated from a motorized crane. The ultimate camera positions are rotary helicopters. Used in combination with a 25–500 mm zoom, these can provide spectacular results and are often used as the camera platform in air-to-air scenes.

Occasionally hand-held cameras are used. One reason for these may be to give the impression of authenticity, as audiences are accustomed to seeing TV documentaries of live action, such as in a police raid. Alternatively, a hand-held camera with a wide angle lens implies that the scene has been seen through an actor's own eyes, particularly if leaves or curtains are brushed aside as it moves forward.

Additional cameras are also used to film action sequences such as chases, where the problems of continuity would make it difficult to shoot on one camera from different angles.

If dialogue is being filmed, the sound crew will pick up the speech using *microphones*, which are mounted on

David Farrell/United Artists

David Farrell

Fixing a microphone *A tiny mike is used to record dialogue when it is not possible to use a boom microphone*

David Farrell/'Brimstone and Treacle'

Recording sound *When there is not enough room on the set, the sound recordist and an assistant watch the action on a small TV screen so that they can anticipate changes in volume*

movable jibs over the heads of the actors. Where characters are filmed from a distance using a telephoto lens, radio microphones may be used. Alternatively the actors will speak their lines later as they watch themselves on film.

The sound crew will also make recordings of any sound effects which are needed, though these may be taken from library tapes of effects. In many cases the film is shot with no sound apparatus present, and all the sounds are added later. This applies particularly to outdoor locations.

At the start or end of each shot in the film, a *clapperboard* is used. This is a board with a hinged edge which can be slapped against the board. On the board are chalked details of the film, sequence and *take* number—many shots are filmed several times, so that the best version can be selected later, each version being called a take. The sound and vision of the clapperboard are linked later, in the editing process.

Before shooting, the producer and director will view the *rushes* of the previous day's shooting. These are rough prints from the original negative, which is then stored safely until the fine cut is made. Even on location there are often facilities for viewing and editing film, so that any unforseen or additional shots can be taken while there is time.

Once all the filming is completed, the detailed editing takes place. This is done using an editing machine of which the Moviola and Steenbeck are the best known examples.

A Moviola editing machine enables the film editor to view the picture image on a screen size of some 100 mm by 125 mm together with the separate sound track. Each of these can be run forwards and backwards either separately or in synchronization and can be stopped for examination, marking and cutting. These machines run action film and sound track in the vertical plane, as in a projector. An increasing number of editors now use a Steenbeck, which operates the film and track in the horizontal plane, on a flat table. It has the advantage of a larger screen, enabling more than one person to view the action, and can run more than one picture and sound track together, so that the editor can switch from one take to another.

The editing takes place on an ungraded print from the master. The joins are made using clear sticky tape so that alterations can easily be made. Gradually the *cutting copy* is built up until the director and editor are satisfied. The soundtrack will be incomplete, consisting mainly of dialogue without music or effects, such as the sound of a car chase.

The *sound editor* will make up music and effects tracks and prepare them for the final *dub* when all the different elements will be mixed together. The music and effects (*M and E*) tracks, with no dialogue, may be provided for foreign sales. The local distributors will dub the dialogue in the language.

Special effects, titles and techniques (such as *dissolves*, where one scene merges into the next) are all prepared on an *optical printer*, combining images.

When the cutting copy has been finalized with all the required effects, the original negatives are cut to match it.

From the negative and soundtrack a *married print* is made. During this stage a *grader* checks that the colour balance is identical from scene to scene, and if necessary makes filtration corrections so that the print is as even as possible. Release prints are then made from a graded copy of the original negative.

If everyone involved in the film has done their job properly, the effect will be that for some 90 minutes an audience will be totally absorbed in what they see on the screen. Few of them should realize the immense amount of work which has gone into making the movie.

Courtesy of De Lane Lea

Dubbing room *sound engineers look into the soundproofed dubbing room and give instructions through a microphone. The equipment is used to mix or double up tracks*

Ray Dunns

Editing *on a Moviola. Some editors prefer this editing machine to the large console of the Steenbeck, especially when a very precise cut in the film is important*

Equipment for hire

Hiring equipment allows you to broaden the scope of your photography without committing you to the expense of buying items which you might use only occasionally

Peter Williams/courtesy of Granada

Still life *For top quality results in this type of photography, you may find it a good idea to hire a complete large format camera outfit*

How many times have you been stuck in the position where your equipment just does not quite match up to the occasion? At a sporting event, for example, your longest telephoto may not have the speed to cope with the poor light, or you may not be able to avoid converging verticals in an architectural shot. Hiring the necessary equipment can help you overcome such problems.

Fast, ultra-long lenses, shift lenses, video equipment, underwater housings, bulk magazine backs, data backs, motor drives and other such expensive items of equipment can be hired either from a specialist hire company or sometimes from your local dealer. Most big cities have photographic hire firms, which you may find by looking in a telephone directory or one of the professional photography journals. Your local library should be able to help you find suitable names and addresses.

Pieces of photographic equipment could also be hired prior to purchase in order to examine their merits and demerits. In the long run this can save you the expense of buying equipment which is totally unsuited to your needs.

Professionals have always believed that hiring can be a more sensible and economical alternative to buying, especially where items which will only be used infrequently are concerned. Unfortunately as far as the amateur is concerned, hiring equipment may be more difficult. Many large rental companies are becoming reluctant to lend equipment to amateurs, arguing that the average amateur has probably only had experience of using one or two cameras whereas most professionals will have handled many.

Nevertheless, rental companies are not opposed to amateurs just because they are amateurs, and do not expect even experienced professionals to be thoroughly at home with equipment which they rarely use. But they are entitled to be careful about who they lend their expensive equipment to, and most will have found that the amateurs who go in not knowing what to ask for or how to use it are a bad risk. Explaining how equipment works to amateurs may also take up too much of the staff's time.

So before attempting to hire equipment, you should try to read something about it and how it works. This may involve obtaining a practical guide to the use of a particular camera from your library, or consulting a friend who already has the equipment. An alternative approach may be to become a regular customer at either a large camera store or the retail outlet of the rental firm itself, so that one of the staff will not mind showing you how the apparatus works.

The conditions of hire can vary considerably from one company to another and before you attempt to hire equipment, it is important to establish just what these conditions are.

Most companies will allow you to rent items by the day, week, month, or longer. However, it is often uneconomical to hire small items for more than a few days. Many rental companies

only hire out the most expensive gear and it may be cheaper to buy a lower priced new item instead. For some equipment such as video recorders there may be a minimum loan period.

Deposits will always be required and will vary in proportion to the value of the equipment. Unless you are a bona fide professional and can produce satisfactory credentials the rental company may insist that you leave equipment of equivalent value as a deposit or a guaranteed cheque for the full retail value of the equipment. Other means of paying a deposit are cash, credit card or, in rare cases, valuables or certified property. If you damage the equipment and repairs are needed, the charge will be deducted from your deposit.

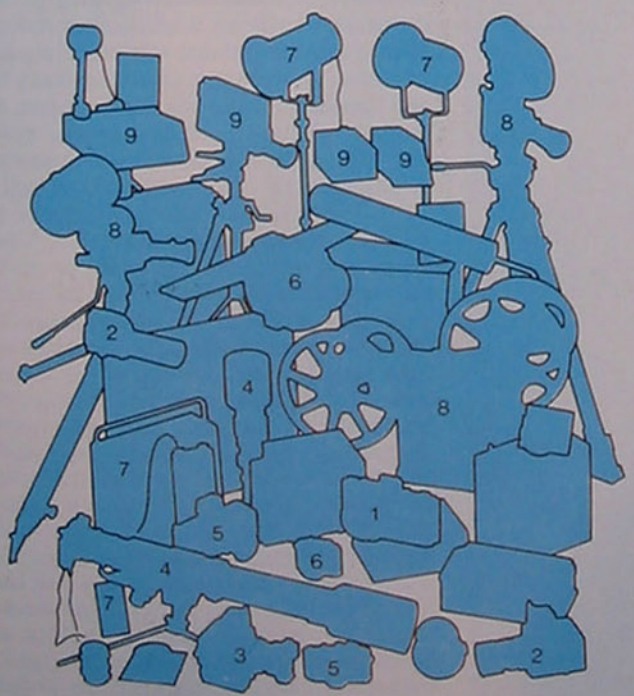
Once you have established a relationship with a particular company and they know that you are trustworthy, you will probably find them more amenable and it is worth returning to them whenever you want to borrow equipment in the future.

Good rental companies always check their equipment thoroughly before they send it out. However, since they usually do not accept responsibility for the failure of equipment, it is always advisable to test it yourself before embarking upon an important assignment or journey.

Insurance of a loaned item is advisable and should always be taken out before you begin the loan. You may fall over and drop the expensive Hasselblad you have just borrowed on your way to the insurance brokers! Many rental companies insist on insurance being taken out and will not release any item unless you have a valid certificate of cover, or take out a policy through them.

Courtesy of Pelling & Cross, London

Equipment you can hire



Equipment types
A wide range of items can be obtained from specialist hire companies. These can vastly expand the scope of your photography, and some of the most useful items are:
1 *motordrive outfit with bulk film back*
2 *medium format cameras* **3** *special lenses, such as fisheyes* **4** *long telephoto lenses*
5 *panoramic cameras—35 mm and 120 formats*
6 *underwater cameras—also in different formats*
7 *portable studio flash heads and power packs* **8** *16 mm movie cameras and projectors*
9 *video cameras and recorders*

Another problem which may confront you when attempting to hire equipment is that of finding the right accessories to fit your camera. Most hire companies have supplies of the more expensive large format cameras and accessories but in the 35 mm SLR format they may only stock equipment made by Nikon, and occasionally by Canon and Olympus as well. If you own a 35 mm Yashica or even a Pentax, it is unlikely that you will be able to hire accessories to fit it from the rental companies. You may be forced to hire a whole Nikon, Canon or Olympus outfit just to get the lens or motordrive that you want.

If you have difficulty hiring the right equipment for the job from commercial rental companies there are two alternative sources you could try. You could join your local camera club or photographic society who may find it easier to hire the gear you need. Alternatively, you could build up a relationship with your local dealer to the extent where he or she is prepared to lend you items from secondhand stock.

Hiring camera outfits

If you are about to go on a short holiday, attend a sporting event, or just want to try out a number of accessories prior

Robinson/Brown

Jerry Young

to buying one or two of them, it may be worth considering hiring equipment to extend your existing outfit. Even quite ordinary items like spare bodies, or accessories such as filters, motordrives or tripods, can be hired. You may like to try out a 300 mm telephoto, to complement your 200 mm, or a 24 mm wide angle for those panoramic landscapes.

Hiring enables you to get the 'feel' for the equipment without the necessity of buying. You can effectively broaden the scope of your photography without committing yourself to unnecessary expenditure on unsuitable or unwanted equipment.

If you are interested in larger format photography but find the equipment beyond your means, you could consider hiring one of the many rollfilm cameras available. They are more expensive to hire than the ordinary 35 mm SLRs and accessories, but for superb pictures of special occasions like a son's or daughter's wedding, for portraiture, landscape or wildlife photography, the extra expense is usually worthwhile.

Hiring movie equipment

If you already own or rent a home video recorder you might like to apply your photographic skills to movie making with a video camera. Kits can be hired which consist of a camera, tripod, recorder and mains or battery units with a full set of leads.

Although instruction books are included with gear of this sort, it is always worth asking for a demonstration before you rent. It is in your own interests to fully acquaint yourself with the equipment since any mistakes you make may well foul up delicate machinery.

The rental charges even for black and white video cameras are high and those for colour outfits may be prohibitive. Hire firms may be reluctant to lend you their valuable equipment unless you can convince them of your ability to operate the machinery. Failure to do this may require you to hire a technician as well!

Much less expensive to hire is an 8 or even 16 mm movie camera. Projectors, too, can be loaned as can screens, standards and zoom lenses. If you already own a movie outfit you might consider hiring a more sophisticated camera or projector for that special occasion.

Hiring studio equipment

For the odd model session, photographic clubs and even many professional photographers find it much cheaper to hire studio equipment. Flash outfits, such as Monolite kits (see page 1085) enable you to turn a room into a temporary studio.

Clubs and societies with regular visitors and a large membership may find the mess of trailing flashleads impractical and may prefer the easily manoeuvred tungsten lamps. For moderate to large sized halls, 'Redhead' kits, consisting of four 800 watt lampheads, or 'Blondes', of 2000 watts per head, can be hired. Kits come complete with proper stands, barndoors and a carrying case.

Care should always be exercised when handling such powerful equipment. If the lamps blow they can send out a shower of molten glass, so safety filters should always be fitted—it is worth checking for this when you hire. Rental companies always include spare bulbs, flashtubes and modelling lamps with all their studio equipment. But if you do have to change a lamp and use the spare you should notify the rental staff and return the blown lamp with the rest of the equipment or you will be charged for it.

Studio accessories like flashmeters, exposure meters and colour temperature meters will have to be hired separately. If the electric wiring in the premises used as a studio cannot cope with the high power outputs required, portable generators of up to 3000 watts can be hired. Background paper supports can be rented for the session although you will have to buy the rolls of paper.

Hiring other equipment

For the occasional slide show at club meetings, family weekends or parties, you can hire simple slide projectors. More sophisticated audio visual presentations may require anything from a control unit and cassette recorder to a complete dissolve package. Spare magazines are included on request. You should bear in mind that the preparation of a slide show can take some time, so you should hire the equipment a few days in advance to allow for this.

If you are hiring a long lens or a large format camera you will also need supports. Depending upon the nature and location of the shoot, a rifle grip or monopod may be sufficient to support a long telephoto. Cameras like the Mamiya RB 67 and the still larger formats,

Ed Buziak

tripods which have fewer mechanical parts to wear out and which are easier to check (see page 751).

Hiring equipment gives you the opportunity to improve your picture taking beyond your normal means. Whether you merely want the convenience of extra camera bodies or lenses on your next outing, or intend to take the plunge with your camera tucked in an underwater housing on your next seaside holiday, renting the equipment may prove inexpensive and the results should justify the cost.

Flowers *Hiring fisheye lenses gives extra scope for experiments and helps you to discover the pros and cons of different focal lengths*

Performers *A portable or hand-held professional flashgun is useful for special occasions when your own unit might not be quite powerful enough*

Explanation *Always be certain you know how to operate the equipment, and do not be afraid to ask the person in the shop to demonstrate if you are unsure*

Wildlife *Trips into the countryside or abroad can be made more rewarding by hiring a long lens to allow you to take pictures of the wildlife*

such as the baseboard technical or the studio monorail cameras need large and heavy tripods and supports.

Portable flashguns with higher output than ordinary amateur units can be rented and may be essential if you want to work at big indoor functions or outdoors at night.

For preparing a special slide show or a portfolio, you can hire a light box for editing your transparencies. Expensive copying equipment like bench top slide copiers, stereo and panoramic cameras and infrared remote controls can be loaned at a fraction of the cost of outright purchase.

Occasionally, retail companies that have a rental side will take up to half the rental fee off your bill should you decide to buy the same or equivalent new equipment within a certain period (usually about five weeks) of returning it. Buying equipment this way has a number of advantages. You can test out whether it feels right and handles well, how it performs, how sturdy it is and whether it offers sufficient versatility for your needs. And you have enough time in between returning the item and deciding to buy to try out other equipment. Not all firms operate this system, however, and it may be worth asking before you hire.

Sometimes companies sell off second-hand ex-rental stock. Although it is possible to pick up a bargain this way, you should always check the equipment thoroughly before buying. Rental equipment is usually well serviced but it is often mishandled and is in constant use. If is always safer to buy items such as

Clay Perry

Understanding...

Basic lens layout

Many of today's lenses are based on designs formulated in the last century. The development of these designs has resulted in complex lenses, but the principles on which they are based remains the same

Early photographic lenses were very simple compared to their modern equivalents, but by the end of the last century, many improvements had been made which improved the quality of the images produced.

In particular, lens designers had realized that an effective way of reducing aberrations while still maintaining a reasonable aperture was to combine positive and negative elements symmetrically —so the negative element helped to cancel out the defects in the positive. The development of anastigmatic lenses—that is, lenses free from astigmatism—was one of the first major steps on the road to fast, high quality lenses, but there was still a long way to go.

One of the most significant advances was the *double anastigmatic* lens. Like basic symmetrical lenses, this used one element to cancel out the defects in another and so improve the performance. But the double anastigmat, rather than combining single elements, combined two complete anastigmatic lens units. One popular double anastigmat lens, for instance, combined a pair of Zeiss Amatar anastigmatic lenses back to back, either side of the aperture. The Zeiss Amatar lenses were triplets—that is, they had three elements cemented together—and the combination gave really excellent correction for distortion and some aberrations, though a small stop was still needed to reduce spherical aberration.

One particular advantage of the double anastigmat was that with some designs the two components could be used separately. This gave a choice of three focal lengths from the one *convertible* lens. The classic example was the *Dagor* which was produced by Goerz.

To give even better correction, double anastigmats were further developed by the process of *splitting* elements —that is, by replacing one element with two or more separate ones. But this led to lenses with up to ten elements. Such lenses were heavy and expensive.

A much simpler but more effective lens was devised by H. D. Taylor, an optical designer, in the late 1890s. He took as his basis the achromatic doublet design which was developed to give an achromatic triplet. This was split into its positive and negative elements, and then the positive part was further split into two elements which were placed either side of the negative element. The three elements were not cemented, but instead were *air spaced*. This allowed the elements to be placed very precisely, relative to each other, for maximum benefit.

This arrangement was called the *Cooke Triplet*, and was a fundamental advance in design because although it was simple, cheap and easy to make, it performed much better than the previously popular Rapid Rectilinear. The maximum aperture was initially only *f*/6.3, but later improvements allowed apertures as wide as *f*/2.8. The design is still used, in modified form, in some telephoto lenses as it gives

Softer shot *The image given by a simple early lens (right) is much softer than that taken with a more complex modern design*

Robinson/Brown

good quality over a small field of view.

The basic three element configuration has been developed to give a huge family of derivations. The simplest of these was achieved by *compounding* the rear element. This is the technique of replacing one element with two or more cemented elements. As with splitting, compounding elements produces better correction by allowing a variety of different lens and glass types to be used together. The classic example is the Tessar, credited to Rudolph in 1902, and still widely used for budget standard lenses up to *f*/2.8.

Other derivatives allowed even wider apertures due to their improved performances. The notable example is the Zeiss Sonnar design which appeared in a number of variants. The early versions had a split front and compound centre elements producing a characteristic thick middle group. Some variants on this design were sufficiently free of spherical aberration to allow apertures of up to *f*/1.5. The quality and speed of these lenses were important in the acceptance of the 35 mm format, especially for available light photography. An important feature of the Sonnar design was that even before the availability of antireflection coatings, it was relatively free from flare, due to the small number of air–glass surfaces. And because it was compact and used large elements, it was remarkably free from vignetting at large apertures.

The Double Gauss design

At the same time that achromatic triplets were being developed, another lens type was also being used. This was the *Double Gauss* design, based on a lens devised by the mathematician Gauss in the early 1800s. This had two air spaced mensicus lenses, both concave to the front. As such it was not widely used. But two lens designers, Rodenstock and Busch, found that two of these Gauss lenses mounted symmetrically front to front, with a central stop, gave excellent correction even using the old glass types. As with other symmetrical lenses, the rear lens group cancelled many of the faults of the front group. In particular, this design gave a flatter field than other lenses of the 1880s.

Lens progress *Lenses became increasingly complex as more and more elements were added to improve performance*

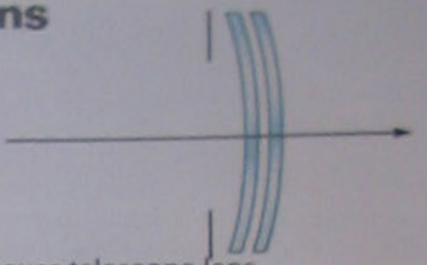
To further improve the optical quality this basic Double Gauss design was frequently modified to produce a large number of Double Gauss Derivatives. The first was the famous Zeiss Planar, designed in 1896, which involved the use of new glasses and replaced the inner meniscus lenses with cemented doublets. As the name suggests, it gave a very flat field. But spherical aberration was not sufficiently corrected to allow large apertures.

The design lay dormant for some time as it was expensive to make compared with the triplet lens. But it was revived in the 1920s when Hollywood needed high definition, large aperture lenses to allow filming by tungsten lighting when sound movies made the noisy carbon arc lamps obsolete. Movie cameras use lenses which cover a narrower field. By using only the centre of the lens's field, apertures of up to *f*/2 were made possible—a good example of this type of lens was the Speed Panchro.

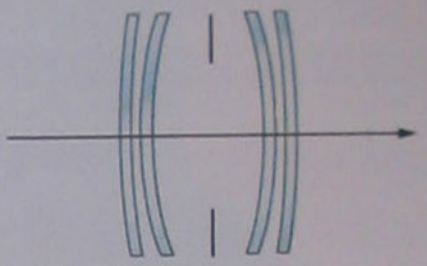
The introduction of the Leica camera in 1925 boosted development of the large aperture anastigmats. The Zeiss Biotar *f*/1.4 and the Leitz Summar at *f*/1.5 were further derivatives with additional elements. The Double Gauss design has now been highly developed and is very widely used today, having benefited from the introduction of new types of very high refractive index glass which has low colour dispersion. This allows fewer elements to be used, though six elements are still needed for a well corrected *f*/2 lens and seven for *f*/1.4.

Before the invention of antireflection coatings on lenses, Double Gauss designs suffered more from flare than contemporary triplets such as the Sonnar, as they had more elements. This led to lower image contrast. But when coatings were introduced in 1935, they gave the Double Gauss design an equal status.

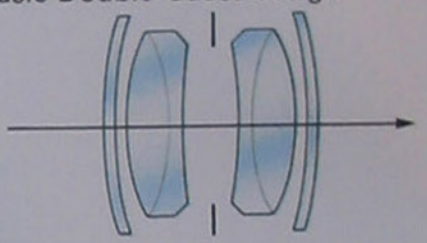
Gauss and double Gauss designs



The Gauss telescope lens

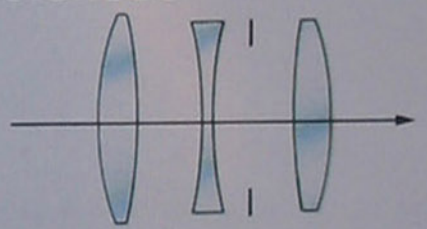


The basic Double Gauss design

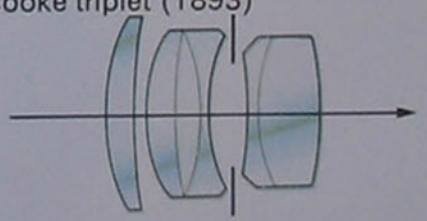


Double Gauss derivative—the Zeiss Planar (1896)

Triplet lenses

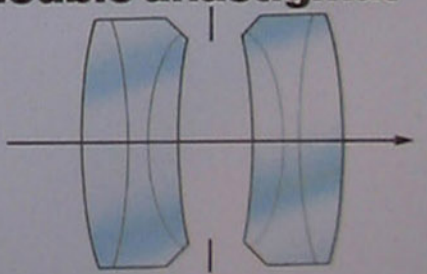


The Cooke triplet (1893)



Sonnar type derivative (e.g. 50 mm *f*/2 Nikkor)

The double anastigmat



Dagor convertible lens (1900)

Nigel Osborne

Snow

Snow transforms landscapes and cityscapes, provides endless subjects for close-ups and gives an excellent opportunity for portrait and action shots, as long as you take a little more care with exposures

Snow is undoubtedly one of the most beautiful phenomena in nature. However, because it is so beautiful it is all too easy just to reach for the camera and shoot pictures almost blindly, assuming that an attractive scene will automatically make an attractive and creative picture. In fact, the blanket of whiteness that envelops everything familiar often looks less good on film than it seemed at the time. Very often the whiteness is either overpowering or simply monotonous in a photograph. Some shots may well be overexposed, while others are grey and dull. But the problems that snow poses for the photographer, whether technical or aesthetic, can be overcome by intelligent handling of contrast and colour.

For the photographer, the overall whiteness is the most striking feature of any snowy scene and tends to dictate the approach, both technically and creatively, whether you are taking landscapes, portraits or abstracts. One point particularly worth remembering—it is usually necessary to find something which contrasts in colour or tone with the snow in order to achieve a successful and attractive image.

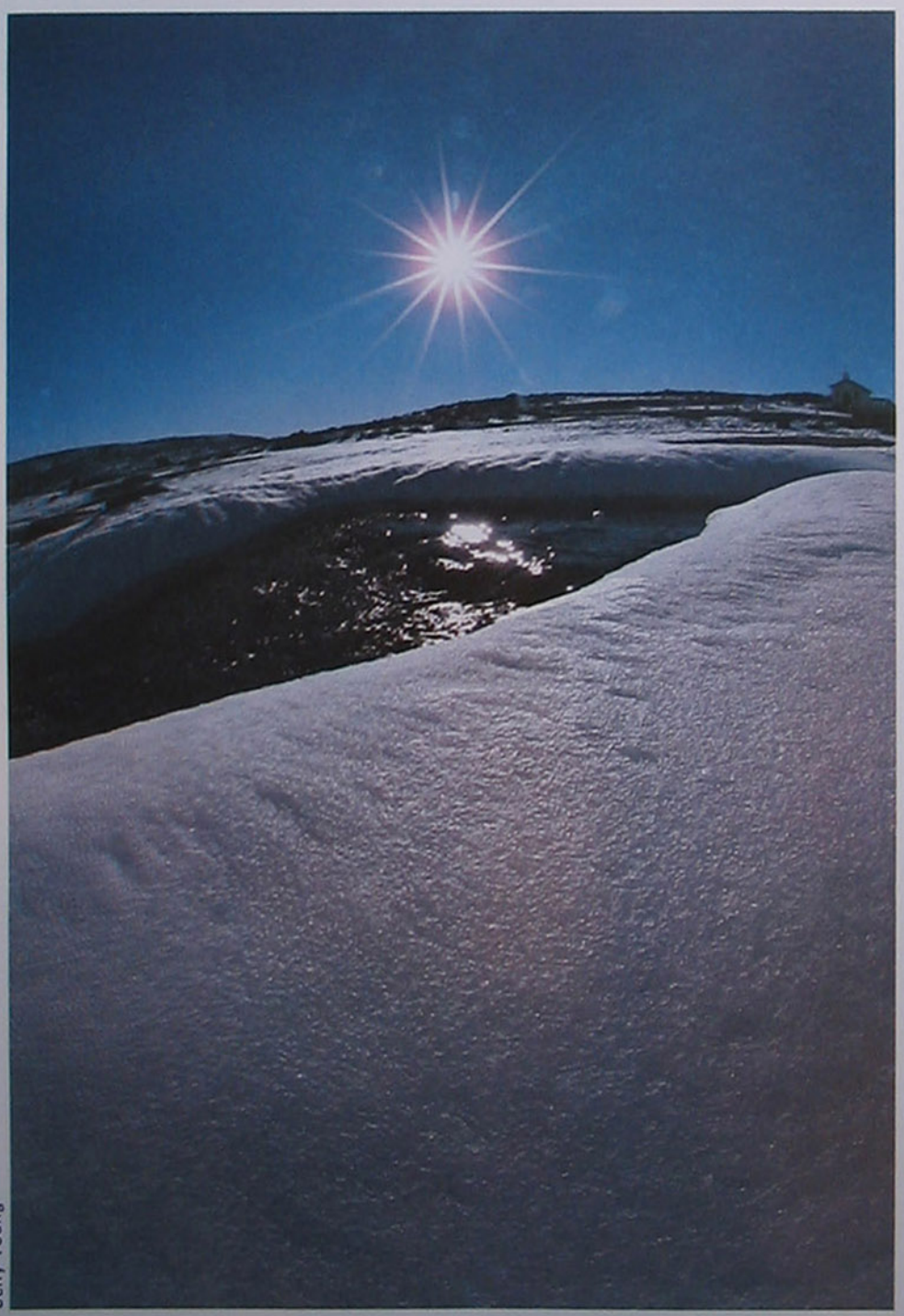
If you are taking a landscape, a bright subject in the foreground—perhaps some winter berries on a tree, a car, a person in colourful winter clothing or simply a child's woollen mitten mislaid in the rush to go tobogganing—can be useful in your composition, not only to add colour, but to give an idea of scale. Once the snow has enveloped everything in a white blanket, it is very easy to lose the sense of scale in a photograph, without some reference to a familiar object.

On the other hand, you can use the extreme whiteness to create surreal, high key effects. This is often easier using black and white film, where it is possible to increase the contrast in the printing stage. A row of trees can become jet black skeletons on a pure white background, for example. You can create very simple, graphic images which set out to make the viewer shiver just to look at them. The essence of the technique is to reduce everything to its basics, and convey the starkness of a winter country landscape.

Drawing on this experience, you can try to create the same sort of effects in colour. In general the only way to control contrast in colour is by choosing your film to start with. Slow films have high contrast, and fast films lower contrast. Snow scenes taken on fast colour film can become very pale and washed out. On high contrast film, however, you can record and even emphasize the wide range of brightnesses in a snowy scene.

Many of the details of the texture of snow are low in contrast, and high contrast film is useful for emphasizing these. On the other hand, under some circumstances the opposite approach might be more suitable, particularly in the city, where it might be more difficult to keep your images simple enough for the high contrast approach. You may, for example, need to include both the snow and details in stonework or buildings, in which case a faster, lower contrast film may give a more pleasing result.

The quality of light can be quite unlike



Jerry Young

Sun and snow *Shooting into the sun can create sparkling, surreal images—particularly if you do not compensate for the bright sun when exposing*

Shadows *Even simple objects such as sticks can produce unusual shadow patterns, which appear pale blue when the sky is clear*

Bill Brooks/Bruce Coleman Ltd.

Nick Holland/Susan Griggs Agency

Sergio Dorantes

Richard & Sally Greenhill

Anne Conway

Garden steps *Simple subjects with geometrical shapes work well when snow covered so that their lines and shapes are clearly outlined. A low sun provides an ideal light for revealing the texture of the snow.* **Red railings** *Bright colours, reds in particular, contrast well with the cold whiteness of snow because of their warmth. In this picture, a close-up of snow and railing spikes makes an abstract design of red and white, while the grey background is thrown out of focus to concentrate attention on the design.* **Tree and landscape** *Late afternoon sunshine often brings a warm, rosy glow to a snowscape which is worth waiting for. If you are shooting into the sun at this time, look for subjects silhouetted against the pale sky beyond.* **Snowman** *Pictures of snowmen often fail because the subject does not stand out against a predominantly white background. As this picture shows, however, a carefully chosen viewpoint makes all the difference, contrasting the snowman against some darker trees behind.* **City streets** *Snow in towns and cities need not always look like a dreary, grey slush. If you take pictures at night, you will find that snow contrasts well with the differently coloured lights. Taken on Ektachrome 200 using a tripod to steady the 100 mm lens*

any other when the weather is snowy. It is a good idea to make the most of this light, since it is as much a feature of a snowy landscape as the snow itself. The white covering reflects light upwards, reversing the normal situation where the light comes from above. When the sky is overcast, the lighting is as flat as it can ever be, and there is an almost complete lack of directionality involved. People's faces glow, and their wrinkles disappear. Even indoors, the lighting becomes strange—ceilings reflect the snow and a person's face at a window reveals that there is snow on the ground, even if the picture does not show it.

The colour of the light, even on an overcast day, can vary enormously. If the sky is quite bright, at midday, film can reproduce colours very faithfully, and the subtle background grey can add to the feel of the shot without recourse to filters. But as the cloud cover thickens and the sky gets darker, the overall colour can rapidly turn blue, requiring an 81 series filter unless you feel that the blue colour will add to the mood.

On a sunny day, everything seems brilliant, and the light reflected from the ground adds to the general illumination. Although the snow appears white, all the shadows are blue since they are illuminated solely by the blue sky. Under these conditions, oddly enough, an 81 series filter can produce a more pleasing colour rendering by removing some of the blue content.

There is some debate about the correct exposure to give in snowy conditions. As always, exposure for transparency film is far more critical, so this is one occasion where negative film can give better results. The problem is that a meter is likely to give an exposure which will render the scene as an overall grey, so there is a tendency to underexpose. This seems to be more of a problem on overcast days than on sunny days, but it is responsible for the failure of many snow pictures. To make matters worse, any overexposure results in unrelieved expanses of white with no tones whatsoever. While half a stop overexposure is probably the best compromise, there are cases where normal exposure, or even half a stop of underexposure, can produce a better picture. To be on the safe side, take a reading from a standard grey card (see page 545). If you bracket, give a range of half stop intervals between half a stop under to one stop over the meter reading to ensure good exposure.

A bright blue sky is a useful source of colour in a snow picture. If the sky is milky rather than deep blue, a polarizing filter may help, but when the sky is really clear, as it can be at ski resorts, a polarizing filter can easily turn parts of the sky almost totally black.

You can, however, use snow to create unusual pictures by the simple technique of underexposing and shooting against the light. This can give the appearance of moonlight glinting on rooftops, for example. Long exposures taken in ths way can produce strangely coloured results as colours shift slightly, and the effects of lens flare can also produce interesting results.

Pictures taken against the sun can often show the texture of the snow itself, with small crystals sparkling. Keep an eye open for shadows of trees seen against the sun—with a wide angle lens in particular these can stand out very dramatically.

Drifts of snow can be worth studying in their own right. They offer great potential for abstract shots, if you close in and remove all other reference points. Concentrate on the shadows and the texture of the snow. By choosing your viewpoint you may be able to turn a fairly small drift into what seems to be a huge mountain.

When snow is on the ground, you may have the chance to take extraordinary night shots. Snow can reflect a large amount of light and even a streetlight can provide enough illumination for an interesting picture, although you may need a tripod at this stage to achieve a sharp picture. If it is a clear night, you may be able to shoot scenes lit only by moonlight. In this case look for the places where the snow is undisturbed and where it will glisten in the moonlight. If you have access to a fairly high viewpoint, you will be able to photograph the rooftops in your town or village in such a way that the different angles and shapes make an abstract composition.

In a city at night during snowy weather, the differently coloured light sources can give you enough subjects for a whole series of photographs. Lights from cafés and shops contrast well with the whiteness of the snow, while the coloured tail lights of cars can provide splashes of warm red against either a frozen white or a slushy grey road. And if you are in the city, where there are cars parked, look out for that strange effect which occurs when a car has been parked before it started snowing, then has moved away, leaving a clear patch on the ground to contrast with the white snow.

Although in most large towns and cities the snow may be cleared away, or

Landscape *Bare trees and hedges in snow are a classic theme. A telephoto shot emphasizes the patterns made by the field boundaries*

Penny Tweedie/Colorific

Chalets *The most interesting details in a landscape can be isolated with a telephoto lens so as not to include any other distracting elements*

Snowball fight *A fast shutter speed freezes the action of both people and snowballs which show up best against a dark, clear background*

may simply melt more quickly because of the slightly higher temperature, in the countryside the snow may persist far longer. If it does, it may be worth making an expedition to find untouched carpets of snow, trees laden with snow, animal tracks, and scenes which you photographed in the summer, totally transformed. You could take along some of your earlier shots to help you capture the same scene. Bear in mind that the roads are likely to be treacherous.

When snow is actually falling, exposure times shorter than 1/250 second should capture snowflakes in the air. A long exposure, around 1/30 second, shows them as hazy streaks, which can give a scene a romantic appearance. A flash exposure as snow is falling shows the nearer flakes very bright and blurred, though frozen in motion, and emphasizes the snowfall. It would be better to use a manual exposure setting rather than an automatic one, as the bright flakes may result in the flash underexposing the rest of the scene.

If the temperature is well below freezing, you may be able to photograph individual snow crystals. They will melt rapidly unless you prepare a cold surface for them. Leave some dark material outdoors, protected from the snow, so that it reaches the outside temperature, then any flakes which fall on it will not melt, and you can photograph them, under cover outdoors, at your leisure. Your main problem will be preventing your breath from melting them, so use a telephoto lens with extension tubes or bellows to get a reasonably large image without having to move too close.

Another area to explore during a fall of snow is that of human interest. Most people enjoy the snow enormously and there is something about it which tends to make people uninhibited about their enjoyment. It is a particularly rewarding time for portraits, candid and action shots as children build snowmen and have snowball fights and people try to skate on frozen ponds and toboggan down slopes. Usually, the clothing people choose at this time is warm and colourful, and if not, faces themselves can be rosy enough to act as a point of colour in an otherwise white scene.

John Sims

Permanent darkrooms

A well planned darkroom can make all the difference to the quality of your results as well as making darkroom work much more enjoyable

A properly designed and permanent darkroom is a high priority of every enthusiastic darkroom worker. It has the supreme advantage of convenience, which enables you—at your whim—to experiment with the various tools and techniques of creative darkroom work without the tiresome business of setting up a temporary arrangement each time.

Choosing a room

Although it is quite possible to convert and use the smallest of spaces as a darkroom, darkroom life becomes much more enjoyable if you can spread your work about yet still have plenty of clear surfaces and storage space to spare. So a good-sized room is obviously preferable —quite a lot of the floor space will be taken up by benching for work surfaces and cupboards.

Any permanent darkroom must have mains services such as electricity and water supply. If these have to be laid on specially, you may find the cost prohibitive. An existing sink, light, and power point can mean that conversion is fairly straightforward.

Also important is the room's ambient temperature. All processing solutions have to be kept at fairly constant temperatures when in use, and so it is helpful if the room is not, by character, a cold one. A cellar, for example, may prove difficult to heat using either the household heating system or spot heating. Rooms elsewhere in a house are likely to have an ambient temperature nearer the ideal—20°C, the norm for black and white processing.

Avoid rooms which are very dusty or damp. Not only will these prove difficult to decorate and maintain, but the conditions may make it difficult to keep equipment clean and in good working order once the darkroom is set up.

Lights and lightproofing

A darkroom need not be a pit of darkness. If you choose the correct type of safelighting, a surprisingly high level of safelight illumination can be used for general purpose work with bromide paper. Safelights can be placed directly on the bench for localized illumination, but are better located on the walls or facing upwards, directed on to the ceiling where they can give very diffused lighting. Some types can be ceiling mounted to give both direct and indirect illumination.

The golden rule for darkroom safelighting is to locate the lights at a safe distance from any surface where sensitive material may be handled. Follow the manufacturer's recommendations on this point. It is more important to have good illumination when you are processing prints than when you are exposing them. So, if possible, mount the safelight over the wet bench rather than the dry bench but make sure sufficient light spills on to the dry bench for you to see to locate paper on the easel.

If prints are to be judged in conditions which closely approximate to daylight, fluorescent lighting fitted with a 'daylight' type tube should be used. Locate the switch for this a safe distance from the safelight switch to avoid accidents. A cord switch arrangement for both is probably the best solution. Professional darkrooms often have a warning light outside the door wired into the safelight circuit, so that people know the room is in use.

The lightproofing arrangements you use can vary from the truly permanent where windows are sealed and doorways extensively baffled, to more temporary efforts employing removable but heavy-duty blinds constructed to fit windows which are cleaned and opened from time to time.

The doorway baffle arrangement you choose can make a great deal of difference to the ease of getting into the room. A two-door arrangement and 'U' shaped tunnel that forms a light trap both permit ready access when the darkroom is in use. But each method may cut down the amount of available space within a darkroom. A single door arrangment, regardless of how well it is baffled at the edges, cannot be opened safely if someone is working in the darkroom. Heavy black curtains over the outside of the door are another alternative, but these can be a nuisance when carrying equipment in and out.

All doors should be provided with locks and latches to prevent forced or accidental entry.

Work surfaces

The more work surface you provide, the more comfortable you will find working in your darkroom. Always provide more than you think you need to allow for the amount of printing and processing equipment you are likely to acquire as your interest in darkroom work grows.

Work surfaces and benches are generally classified as being either 'wet' when used for processing, or 'dry' when used for printing operations. Water and process solutions on the wet bench must not come into contact either with the power leads, plugs and sockets of the enlarger and other items of the dry bench, or with dry negatives and printing paper normally to be found there. Ideally, therefore, 'wet' and 'dry' areas should be kept physically separate. But an aisle between the two of more than one metre is an unnecessary waste of valuable floor space.

If you are starting from scratch and can afford to include one in your design, think about installing a really large but fairly shallow sink. This could act as your wet bench, and anything and everything to do with film and print processing could be arranged neatly either within the sink, or very close to it. Dishes can be spread along the length of the sink for print processing, and water in the sink could act as a water bath for temperature control. When needed after film and print processing, used utensils can simply be hosed down and left in the

Dave King

Compact design *Even a small room can be converted into a professional type darkroom providing you arrange equipment and work surfaces to maximize space. The wet bench area of this darkroom is simply one large sink and dishes and processing accessories can be spaced out in the sink and simply hosed down after use. A large light box is vertically mounted to conserve space on the dry bench*

Work heights *If you are making your own work benches remember that the dimensions of these must take account of the job being done and whether you are standing or sitting*

Ventilation

Confined spaces, chemicals and vapours yield a combination which makes life uncomfortable unless suitable arrangements are made to have the room properly ventilated during the time printing and processing takes place.

Ventilation is always essential for comfortable working conditions and to discharge obnoxious fumes given off by chemicals nearing exhaustion or those which have been contaminated. Some of the darkroom processes such as toning make use of rather smelly chemicals, which are particularly unpleasant—and sometimes harmful—in a confined space. Even if these have to be used in the darkroom, try preparing them elsewhere to lessen the effects.

Permanent darkrooms can be provided with efficient extractor fans (some are available specifically for use in darkrooms) but simple light-trapped vents can perform just as well for the smaller darkroom. A suitable ventilation baffle can be built into a door, and this must be installed if an extractor fan is used, especially if windows and doors are tightly sealed for light trapping purposes. If you cannot provide adequate throughflow ventilation for your darkroom, make a special point of airing the room at regular intervals simply by opening the door and taking a break.

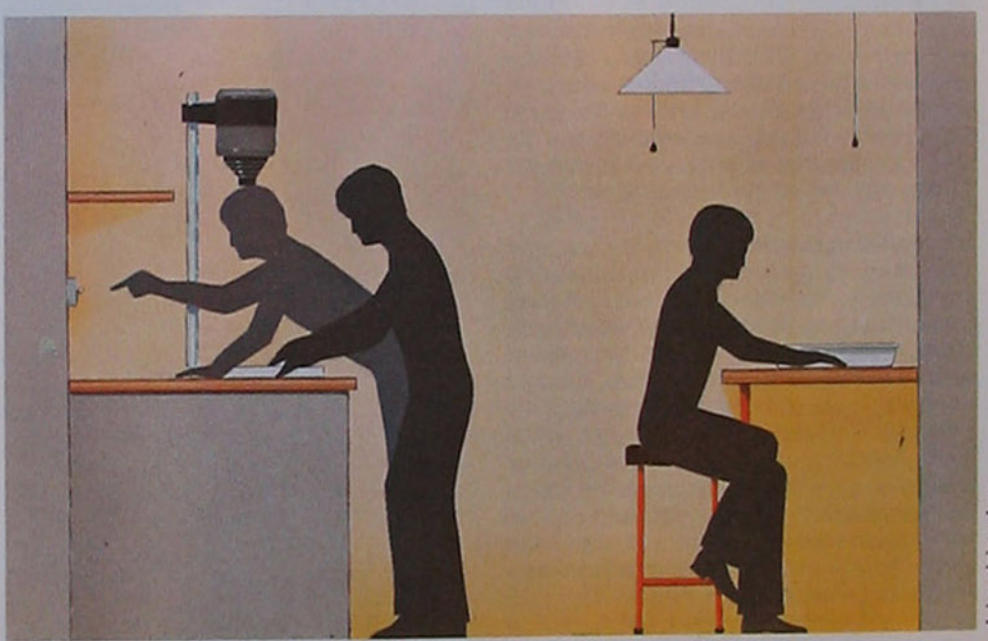
sink to dry—which greatly lessens the chore of cleaning operations. Professional darkroom sinks are often stainless steel, but porcelain is adequate. Large sized darkroom sinks are commercially available, or you can construct your own. Each can be custom made to your precise requirements to fit existing plumbing arrangements.

The dry bench should consist of a large area worktop at least 60 cm deep, with outward opening cupboards beneath. All nearby walls can be fitted with shelving. Plastic laminated surfaces are ideal as these clean easily and resist chemical stains. If the ceiling height is too low for the maximum extension of your enlargers, consider fitting a dropdown top to the dry bench.

Although the layout and size of the available room inevitably influences the arrangement, plan your wet and dry areas according to the printing and processing routine you use. For instance, you may prefer an L-shaped arrangement of the two areas rather than have one each side of a long dividing aisle.

Storage

On the spot storage provided by customized shelving and cupboards is one of the most apparent 'luxuries' of a permanent darkroom. Locate shelving for items such as processing tanks and spirals near to the wet bench, for example. And you will want a cupboard near where you plan to do your enlarging, to act as a temporary store for paper and a home for filters and other enlarging accessories. But try to arrange a system, once again, where anything to do with the wet side of operations is kept clear of anything on the dry side to prevent damage and accidents. For example, if your dry and wet benches abut, the dry side should be higher than the wet.



Advertising Arts

All chemicals must be locked in a cupboard—if you have children, simply keeping the chemicals out of reach is not adequate. Sensitive material such as film and paper must be stored away from chemical fumes, and preferably somewhere much cooler than normal room temperature. The ideal method is to use an old refrigerator kept exclusively for this task. Fit a lock and padlock for safety, and for long term storage, place material in airtight plastic bags.

Running water

Although it is quite possible to make do without a mains or tapped water supply, running water is clearly a tremendous asset in any darkroom. Hot and cold supply is a major—and potentially expensive—requirement for a proper, permanent darkroom.

The alternative to a sink and a tapped water supply is to use bowls of water that have previously been transported to the darkroom. A rinse bath at the end of the fixing period is normally sufficient until such time as processing ends and the whole output may then be transferred to the bath for the final, all-important wash.

Waste outlet

All chemicals used in photography are potentially harmful to other substances and some care must be taken over the disposal of used solutions. It is generally considered that copper piping is adversely affected in this way: this may rule out some existing plumbing systems. Lead and plastic piping are less affected by the action of chemicals used in black and white processing.

If you are in doubt, the WC and its subsequent flushing is the best method of waste disposal, but seek advice from your local authority if this is drained into a cesspool or a septic tank. If you need to work away from a suitable waste outlet, a 'dump' such as a large plastic dustbin is all that is required. Used solutions may be transferred to this for convenience if fresh stocks are to hand—but any chemical action between discarded solutions could lead to unpleasant fumes.

If you are planning the plumbing for a more permanent darkroom, arrange for a large-bore plastic waste system for direct disposal of waste to the soil stack of your home. But do ensure that the traps in the piping are adequate and readily accessible so you do not have to dismantle fixed benches. Always seek the assistance of a plumber.

Discarded test strips, cleaning cloths and wrappings can quickly mess up the floor of a darkroom unless waste buckets are provided. Cardboard boxes, are unsuitable for collecting wet test strips—you need large plastic buckets or small dustbins for the job. Locate one near the enlarger, another near the wet bench for direct disposal of discarded prints.

Mains electricity

A number of items of equipment used in connection with the various printing operations require mains electricity supply, and for safety's sake it is preferable to use something more than a single ring-main socket for this. A spur from the existing ring main can provide up to three additional sockets, but this is strictly a job for the competent electrician—and a legal requirement in some countries. Electricity and water are a lethal combination at worst so observe this safety checklist:

- Do not allow the various dishes of process solutions to come near to wires or equipment.
- Mop up spills right away, particularly those near electrical appliances.
- Never overload the mains socket by using a series of adapters.
- Keep sockets well away from main wet bench areas. As a rule, it must not be possible for you to touch or switch any electrical appliance when standing and working at the wet bench or taps unless cord switches are used.
- Use fused appliances or sockets.
- Make sure that all connections are electrically correct, particularly if equipment is repeatedly unplugged.
- Do not allow wires to trail loose on the floor where spills are likely—trailing wires are also easily tripped over.

Room finish

Perhaps the most popular misconception concerning the word darkroom is that it needs to be painted completely black—in fact the best paint finish is white or yellow. Use semi-matt for walls and ceiling in good condition, and a cement base paint for previously unpainted brick or cement walls.

To cut out reflections the area of wall near to your enlarger should be painted matt black to minimize lamphouse light reflections, but for temporary set-ups this is usually impracticable. Matt black cartridge paper performs the same function with the significant advantage that it is both removable and disposable should it become soiled. The rest of the room can be as lightly coloured and reflective as you like—in fact the more so

Darkroom layout *Separate wet and dry work areas eliminate many of the messy problems associated with a temporary darkroom. Many of the design ideas can be used in a temporary set-up*

1 Safelights at correct minimum distance. 2 Ventilation is best provided by an extractor fan, and light-proofed versions for darkroom use are available. 3 Wall-mounted clock, positioned somewhere convenient. 4 Matt black finish to cut down enlarger light leaks. 5 Good, strong lighting for easier assessment of results. 6 Lock on door; use the back for spec sheets and times. 7 Noticeboard near enlarger for exposure information. 8 Up to three sockets can be wired to a spur from a ring main. Sockets should be above the work surface. 9 Use individual plugs for each appliance except for the timer, and keep leads short to avoid trailing wires. 10 Enlarger accessories provided with convenient storage. 11 A dry bench large enough for 'workroom' operations. 12-15 Plenty of convenient storage for paper, measuring utensils, process timer and processing drums. 16 Wet bench large enough for dishes and sink. 17 Bathroom or kitchen type tiles on wall. 18 Porcelain, stainless steel or glass-fibre sink. 19 Plenty of storage space for wet bench accessories. 20 Waterproof floor covering (vinyl tiling is best). 21 Check waste arrangements with a qualified plumber. 22 Old containers and bulk quantities of chemicals require a large amount of storage space.

the better. Use tiling near the wet bench to prevent splash damage and enable easy wiping down.

Take a look at the floors next. Chemicals can damage most types of floor covering. Carpets must be avoided. Linoleum flooring suffers from prolonged contact with chemicals and moisture, so spills must be wiped up immediately to prevent seepage to the flooring beneath, as this may lead to structural damage in the long term. PVC flooring is the most resistant of the modern floor coverings and is the best choice for a permanent set-up. When laying this, seal joins with waterproof tape and turn up the edges where the floor covering meets the work tables and walls. This should minimize the seepage problem. At slippery spots, near the wet bench, a rubber mat can be added.

Temporary set-ups

A permanent darkroom is, sadly, beyond the reach of many. But with careful planning, a temporary set-up can provide many of the benefits of a proper darkroom. The only real difference of a makeshift set-up is the temporary nature of the blacking-out arrangements—and the real need for somewhere safe to store chemicals, materials and equipment after each session.

Baffles or blinds can be used to make almost any room light-tight (see pages 26 to 28), but it is best to choose somewhere small and clean—like a boxroom—to start with if a temporary arrangement is needed as only a door and a window will need attention. You may, however, decide that permanent blacking-out is preferable to temporary arrangements where a spare room can be converted into a temporary darkroom.

For temporary set-ups where blacking-out is complicated and not particularly efficient, consider waiting until nightfall before beginning work. Often a thick curtain is all that is then required to cut out weak streetlighting and moonlight at the window. For doors, simply pin a blanket over the frame but, if you do not wish to mark the door frame, use weather strip or draught excluder in the door frame cracks. Fit the door with a lock to prevent accidental entry.

Whatever arrangements you make, always test the efficiency of your blacking-out operations. Switch off all lights and allow your eyes to adapt fully to the darkness. If, after several minutes, you still cannot see a hand waved in front of your face, conditions can be considered safe. Any light leaks should be easily traceable and a strip of black masking tape is all that is needed to cure many of these. However, take care not to create an airtight space—which is especially important in small rooms.

Although you may not have the luxury of being able to custom-fit your benching, you may be able to move tables and other work surfaces around until you have created a suitable arrangement of work surfaces. A sink and draining board, for example, could act as a wet bench, and a table nearer to power sockets could be used as a dry bench. Again beware of trailing leads—and avoid the potentially lethal combination of electricity and water. This is why it is best to disregard the popular suggestion of converting the bath and bath top for use as a combined wet and dry work area in a temporary darkroom set-up.

Of course, almost any form of bench or table can be used for the wet side if a sink and running water are not available, but one which has an easily wiped down surface—such as Formica or melamine—would be preferable. Otherwise protect the worktop—and nearby flooring—from the inevitable spills of processing solution, using old newspaper, plastic sheeting or towels.

Whether you establish a permanent or a temporary darkroom, it is important to plan all the details carefully, and it is always worth taking a little extra time to do things properly—such as mounting equipment or providing drains—rather than taking shortcuts. If you do this, your darkroom should be a pleasant place to work in.

Planning a permanent darkroom

Paul Williams

Fly a kite!

If the idea of aerial photography appeals to you, but the cost of a light aircraft is out of reach, why not consider a kite? They are cheap to buy, and can hoist your camera hundreds of metres into the air in seconds

Aerial photography can, quite literally, give you a new angle on a traditional subject. Although it has always been thought of as exotic and expensive, good aerial pictures can be taken using just a kite to get the camera into the air, and it is very easy to take photographs from over a hundred metres above the ground.

At first sight, this may seem a little risky—kites do not exactly have a reputation for reliability—but with the right kite, and a carefully designed camera rig, there is little danger of your camera crashing unceremoniously to the ground.

The choice of kite is very important. Kites of one sort or another have been in use for thousands of years, and their shapes have evolved along a number of different lines. Some kites are built for manoeuvrability, and these quickly respond to a tug on the string, or a slight shift in the breeze. Other types are highly stable, and hover in a fixed position in the sky, almost completely immobile.

From a photographic point of view the latter type of kite is ideal, as it provides a steady camera platform which neither swings like a pendulum nor vibrates violently.

A number of different shapes of kite are suitable as platforms, and any kite enthusiast or retailer should be able

to point them out. Some designs, though, are quite expensive, and the best compromise between expense and lifting ability is provided by a design called a *Roller*. This is the type of kite in use in the accompanying photographs. A 1.5 m Roller is widely available, fairly inexpensive, and powerful enough to lift a compact 35 mm camera. Larger versions of the kite can safely lift larger cameras.

It is very tempting to build a kite at home, but this is not usually a good idea unless you are an expert. The exact dimensions and shape of a kite can substantially affect its stability and performance, and it is much better to buy a high quality, professionally made kite than to run the risk of a home-made kite breaking up in the air.

way of doing this is to fit the camera to a framework with a sail and hang it from the kite cable. When released, the sail and camera run up the line, until they strike a stop. This releases the shutter, and disengages the sail, so that the whole apparatus slides back down the line to the photographer, who simply cranks the lever wind and sends it back up the line again.

With a motor winder, you can take a series of pictures while the camera is in the air, and if you want to fire the camera by radio control, a drive or winder is essential. It need not be a sophisticated motor, however, and an ideal type of camera is a clockwork driven 35 mm compact.

a cheap instant-load camera which is more or less expendable, then the safety of the camera may be less important.

Making a camera mount

The obvious way of using a camera and kite together is to fix one to the other directly, but this solution is by no means the best. Every time you want to retrieve the camera, to wind on or change the film, for instance, the kite must be reeled in, and in a fresh breeze, this can require a considerable effort. It is not unusual for a kite to have a lifting power of 20 kg, and reeling in such a kite is comparable to hauling a packed suitcase up the side of a high building.

Jerry Young

Flying a camera *A 1.5 m kite provides lift, and a wooden stop is tied on 30 m below it. The camera, fixed to a small sail, is blown up the line by the wind. Exposures are made either by radio control, or by pressure on the cable release when the sail hits the stop (bottom left). This action also pushes a sail-release device (top right) and the camera slides down the line (above)*

Virtually any camera is suitable, though obviously weight is an important factor—a lightweight camera is easier to get aloft than a heavier one. If you have a motor drive or winder, this allows you to take a series of pictures without bringing the camera down the line, but a manually wound camera is easily adapted for use with a kite. The simplest

These can be cheap, and take as many as ten frames at one winding of the clockwork mechanism. They have the added advantage that they weigh only half as much as a 35 mm SLR.

Whichever kite and camera you use, you should take care to carefully match the two. If you are using a very expensive camera, it is crucial that the kite is completely reliable, but if you are using

Jerry Young

Flying fisheye *With an SLR mounted on the sail, you can experiment with a variety of focal lengths*

The system mentioned earlier—of mounting the camera in a separate mini-kite—is better and more versatile. The camera and a fabric sail are attached to a rod, which slides along the kite line on a couple of loops of wire. The sail can be made from any non-porous fabric—a closely woven nylon is ideal. Unlike the kite itself, its dimensions are not critical, so it can easily be made on a sewing machine at home. For spars, use wood or aluminium tubing.

Like the dimensions, the method of construction is not critical, and should be adapted to local conditions and the materials you have available. The framework used to take the accompanying aerial photographs was made largely of PVC tubing, but this is impractical in very warm weather, as the plastic tube becomes flexible and sags. Non-rigid materials are particularly useful, however, because they have a damping effect, and transmit shocks and jerks to the camera less easily.

Releasing the shutter

Although you can operate the shutter release by remote radio control, there are a number of simpler methods of ensuring that the shutter is fired at the right moment.

One of these is to use the camera's self timer. In a strong breeze, the sail and the camera can be blown a long way up the kite line before the self timer winds down and releases the shutter.

Another method is to arrange for the shutter to fire when the camera and sail reach a preset point on the line. This is done by knotting a ring, or a piece of dowelling into the kite line, to form a 'stopper'. The camera-sail assembly is then fitted with a plunger arrangement which is connected to the camera's cable release. As soon as the sail rises to the preset stopper point—usually 30 m or so below the kite itself—the plunger is pushed, and the shutter released.

This stop and plunger technique can also be used to return the camera to the ground. The rig illustrated here is held together by a string that runs from the tip of the sail to a ring which is retained by the plunger. When the plunger strikes the stop, the ring is released, and the sail flaps free, quickly losing its lift. The camera and sail float gently to the ground, and their descent is slowed by the flapping sail.

Though this home-made release trigger may sound ramshackle and improvised, it can work very well, and with a little ingenuity, quite a sophisticated release system can be built around it, particularly if the camera also has a motor and a self timer. Nevertheless, the versatility of this system is limited and for extra control it is worth using remote radio control.

Radio control

Although there are no units available specifically for this purpose, the equipment used for radio control of model aircraft and boats is no longer very expensive, and it can easily be adapted for camera use. A standard two-channel kit usually consists of a hand-held transmitter, a receiver, a battery pack and two *servos*. Servos are small electric motors which convert a signal from the receiving unit into a physical movement. To operate the shutter of a camera, for example, a servo can be connected to a cable release, or simply pull on a rod that presses against the shutter release.

The servo is the only part of the radio control unit that must be mounted close to the camera. The other parts on the receiving end—the receiver itself, and the battery pack—can be strapped to the camera support framework with tape.

Since the other channel of the radio control remains vacant it could be used to change the direction in which the camera points, or the focal length of a zoom lens.

Flying and photographing

Before sending your camera up on a kite, make sure that you are confident that you can safely launch, control and land the kite on its own. This is easier if you have another person to help you, but if you still have difficulty, you may be doing something fundamentally wrong. If you do have problems, there are several excellent books about building and flying kites which may help to pinpoint the fault.

Choose an open space with few trees, and something interesting nearby to photograph. Do not forget that a subject that looks good on the ground may look boring from the air.

A very strong wind is not necessary for flying kites, and may actually damage them. Wind at ground level is usually much slower than it is at 50 m, so be prepared for a strong tug on the line as the kite rises. Fit the kite with heavier line than usual—if the instructions recommend a breaking strain of 20 kg, use line that is twice as strong, because the added weight of the camera puts an extra strain on the line.

Before launching the camera, run a test with a dummy, such as a half brick, and make sure that the whole system works properly, particularly the stop and plunger device that returns the sail to the ground. When the time comes to fit the camera to its mounting bracket, use more than one fixing point. For example, if the main point of attachment is the tripod socket, you should also run a safety line between the camera's strap lugs and the frame of the sail assembly. This reduces the risk of damage.

Infrared landscape *Infrared film adds unreal colour, but has practical uses in archaeology and crop surveys*

Vertical Visuals

Aiming the camera *Take care in lining up the camera. Avoid pointing it straight down, as far more interesting pictures are produced when it is directed towards the horizon*

Vertical Visuals

Adjust the orientation of the camera so that it does not point vertically downwards, or you will end up with dozens of pictures of the grass. An angle closer to the diagonal is better, so that both the ground and the horizon are in the picture. If you have a choice of focal lengths, use a wide-angle lens, as this reduces the effect of movement of the camera cradle in the air. If the camera continues to swing about violently, try fitting a tail to the camera itself (not to the kite). This provides a degree of drag which stabilizes the camera.

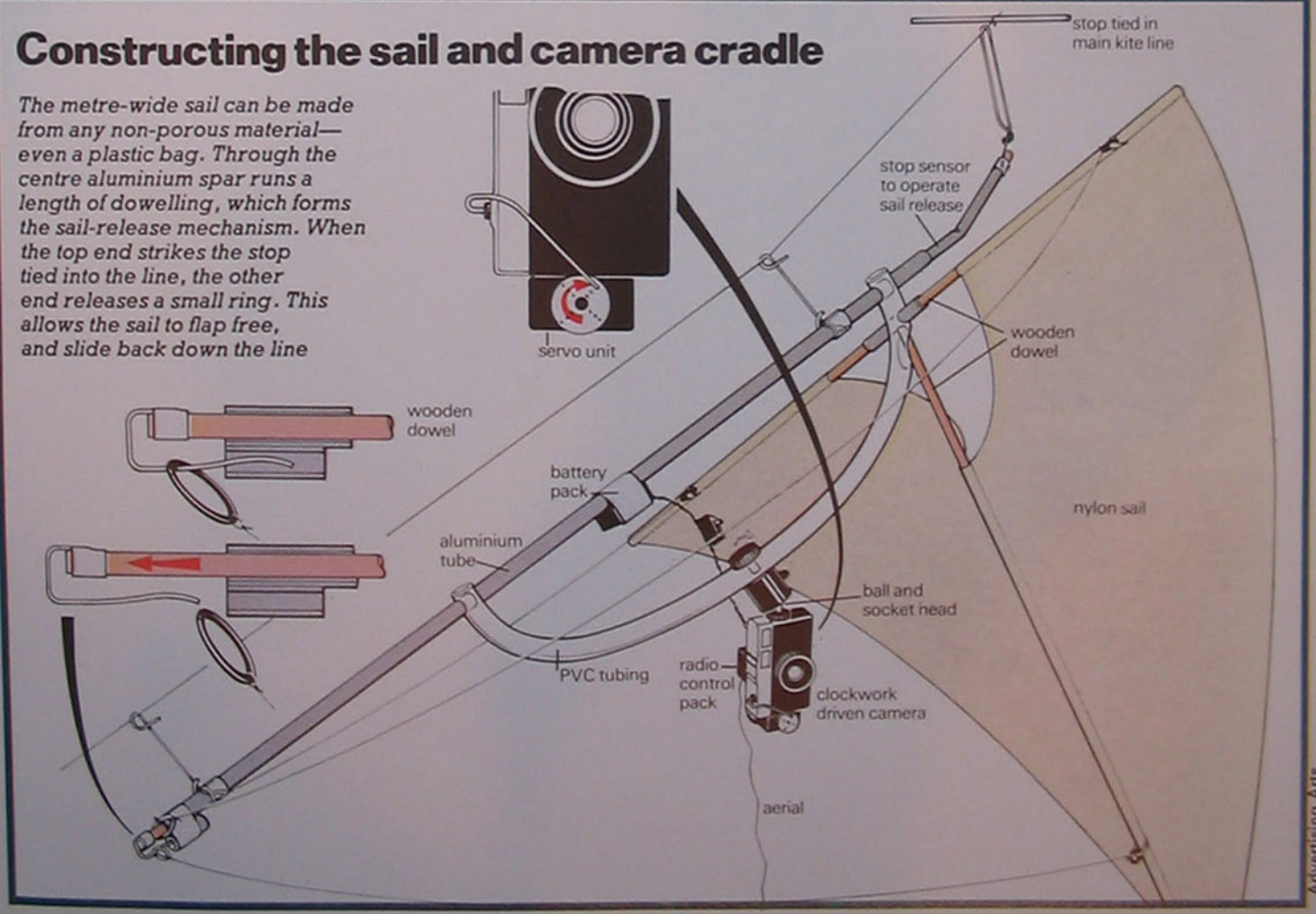
Set the focusing scale to infinity, and the exposure controls according to the prevailing weather. On manual cameras, you should use the fastest shutter speed possible. Since the whole subject is a distant view, a small aperture is unnecessary, though it is advisable to close the lens down a little from full aperture—no lens gives its best when wide open. Automatic cameras, particularly the cheaper ones, often give you little choice in the exposure setting. If you are using an automatic without manual override, you may be able to force it to set its fastest shutter speed by using a fast film, but beware of overexposure.

When you release the camera and sail, and watch it slide up the line towards the kite, you will probably find that you have more control over its position than you expect. The sail rises fastest when the line is tight, and you can use line tension to control the rate at which the camera climbs. Do not be tempted to send the camera too high, or you may get pictures that show only a mass of distant detail. Furthermore, there is often a legal ceiling on kite flying. For distant views, 50 m is quite high enough for the camera, and if you want to be able to identify figures on the ground, the kite needs to be very low—20 or 30 m is ample.

Vertical Visuals

Constructing the sail and camera cradle

The metre-wide sail can be made from any non-porous material—even a plastic bag. Through the centre aluminium spar runs a length of dowelling, which forms the sail-release mechanism. When the top end strikes the stop tied into the line, the other end releases a small ring. This allows the sail to flap free, and slide back down the line



Advertising Arts

Assignment

BMX

Bicycle motocross—BMX—is more than just youngsters having fun. Jerry Young shows that it is also a serious sport which can yield exciting photographs

BMX, or bicycle motorcross, has become a very popular sport with youngsters in several different countries, offering serious competition and intense excitement. Progressing from an interest in skateboarding, photographer Jerry Young found that the same locations were being taken over by young people engaging in the more photogenic sport of BMX. After spending a day photographing them in a skateboard park, Jerry followed up his interest by spending a day at an organized event.

In the skateboard park Jerry could count on the cooperation of the riders who obliged by performing their well rehearsed stunts in front of the camera. For these shots Jerry fund that a low viewpoint accentuated the acrobatics of the riders while also allowing him to frame the subjects against a deep blue sky. He went out of his way to wait for a day with perfect weather conditions and the shots show how much the colour of the sky helped. Often a polarizer was used to strengthen the bright colours.

Jerry also found that wide angle lenses were best for this sort of approach—especially his 16 mm full frame fisheye which accentuated the curved lines of the concrete slopes. Wide lenses also create a sense of involvement by giving the impression that the bikes are riding right at you. To freeze the movement, Jerry used a shutter speed of 1/500 second. When shooting straight into the light this meant an aperture of about *f*/8 but for shots which included less of the bright sky, a wider aperture was needed. All shots were taken on Kodachrome 64 to make the most of the bright colours. Many of Jerry's track shots were taken with longer lenses, so he could reach into the thick of the action. To lift the main subjects away from distracting background details, Jerry used flash for some of his shots. Using a shutter speed of 1/30 or 1/60 second to create a sense of movement, he selected a lens aperture which balanced the flash with the ambient daylight so that the background did not appear underexposed.

Defying gravity *Lying in the bottom of a skateboard bowl, Jerry produced this exciting shot by fitting a 16 mm lens to exaggerate the curvature*

Round the bend *Here an 18 mm lens included both the riders going around the banked bend and the diagonal row of colourful flags*

Wheelie *This shot was taken while the rider performed specially for the camera. Shooting from ground level, Jerry used a 24 mm lens and a polarizing filter*

The start *Using an 18 mm lens, this shot was framed to include all the starters and to show the professional-type clothing and equipment that are used*

Downhill *One of the best positions at a BMX race is at the bottom of the hill where the riders gather speed; a 300 mm lens helps to fill the frame*

Silhouettes *BMX can look good in silhouette too. Here again, the shot was set up for the camera and Jerry used the 16 mm fisheye lens*

Up the wall *To get this view, the camera and a 24 mm lens were held over the edge of the wall as the rider tested his skills for the photographer*

Flash *This demonstrates how effective a small flash gun can be for brightening overcast daylight and lifting the subjects away from the background*

Jerry Young

What went wrong?

Identifying image faults

Different causes may produce very similar faults in your final image. Some of these can be eliminated, but it is important to identify them in order to stop them from recurring

Marks such as these may be caused by an obstruction in the field of view (left), but the similar mark on the right hand picture is due to light fogging the start of the film

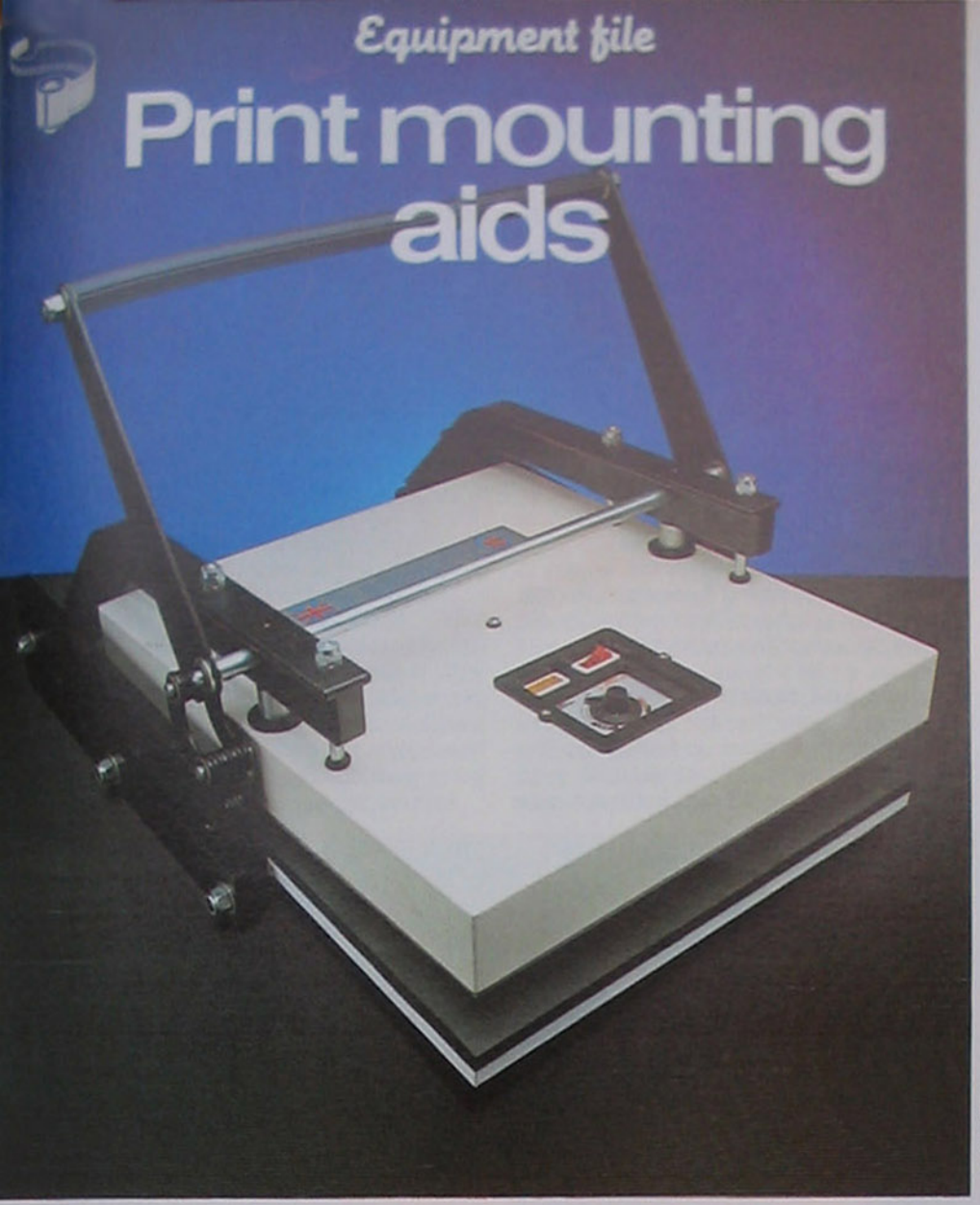
The film caught the light in the cassette (left) causing the pink fogging. Though similar in appearance, the mark on the right was caused by someone's shoulder at close range

Film catching the light can also cause flare-like fogging (left). A flare effect may also be the result of a 'hot spot' in a lens (right)—notice the subject is not backlit

Dark marks on an image may be caused by a lens fault, such as internal flare within the lens (above). However, a camera strap dangling in front of the flash tube can have a similar effect (below)

Equipment file

Print mounting aids



Dave King

Good pictures deserve good presentation, and, for prints, the best method is dry mounting. But to get the most out of this technique it is important to have the right equipment

Prints can be mounted on to card, board or almost any other material with little or no special apparatus, using one of the wet or cold dry methods described on pages 740 to 743. And with patience and care, results can be more than satisfactory. But with special *hot mounting* equipment, you can achieve a really professional look very easily.

With hot mounting techniques, it is easy to avoid the normal pitfalls of print mounting—air bubbles, lumps and creases—and achieve a good finish virtually every time. It can also be remarkably quick and clean and provides the scope to apply a variety of special finishes. Unfortunately the necessary equipment is very expensive —even the cheapest hot mounting press can cost more than a basic SLR.

The basic equipment for hot dry mounting is a flat heat source, and a tissue impregnated with shellac or a similar substance which is dry at ordinary room temperatures but melts when heated. The tissue is placed between the print and the mount and, when heated, the shellac melts and sticks the print firmly to the mount.

Although you can hot mount with an ordinary domestic iron, it is difficult to achieve good results. The temperature of an iron is rarely even over the whole surface and it may fluctuate from time to time because the thermostat is insufficiently sensitive. This means that it is impossible to perform many special hot mounting techniques, such as adding surface texture to the mounted print, because this needs accurate temperature control. Nevertheless, if you cannot afford a special mounting press, it is certainly worth experimenting with an ordinary iron.

Similarly, you can use an ordinary domestic iron to tack the tissue to the print and mount to keep them in position while under the press. Proper tacking irons are much better, however. They give you greater control over heat output and are thus less likely to damage your prints.

Mounting presses

A purpose-built mounting press has a flat base on to which the mounting material, tissue and print are placed, and a heated platen which is either hinged or screwed down during mounting.

There are two types of mounting presses: *soft bed* and *hard bed*. The soft bed type has a compressible material, usually a kind of firm sponge, as the base of the press, and a flat, metal platen above. The hard bed type has a completely flat metal base. Either is equally effective for hot dry mounting, although the hard bed type is suitable for 'cold' mounting as well—soft bed presses cannot usually provide sufficient pressure for cold mounting.

One of the first things to consider when choosing a press is its size. Presses vary in size between portable desk top types about 30 × 25 cm to large and expensive free standing ones up to 50 × 60 cm. Choose a press size to suit the size of prints that you want to mount. Although it is possible to mount a large print on a small press by feeding it through in sections, this is time consuming and can produce uneven and unsatisfactory results. A larger press does the job much better. If you can only afford a smaller press, look for one that is open on three sides, or which has space all around it to allow larger prints to be mounted in sections. A small 25 × 30 cm press which is open on three sides can be used for mounting prints up to 60 cm wide and of any length.

If you want to buy a large press, it is worth making sure that the power source in your darkroom is sufficient—the largest presses often have a heating

Mounting press *The most useful item of equipment for top quality print mounting is the mounting press (above left). Most models have thermostatic controls (above) which allow the temperature of the press to be altered for different types of paper. Another useful feature is a light which tells you when the press has reached the required temperature*

element of several thousand watts and may require a 30 amp power supply.

The heating control system is another important feature to consider when selecting a dry mounting press. The system should be capable of reaching and maintaining a temperature sufficient to melt the adhesive without damaging the print materials. This is normally around 80°C.

Some presses have a built-in thermometer or coloured lights which indicate when the press is warming up and when it has reached the correct temperature. Some have an adjustable thermostat as well—others have only an adjustable thermostat marked either with temperature settings or index marks. Index marks can be a nuisance because you have to make tests to find the best settings for different types of print material. Double weight fibre-based papers, for example, can normally be safely given a little extra heat to speed up the mounting process while resin coated papers must be treated more carefully—the polythene coating of the base tends to melt if too much heat is applied.

It is also worth considering how long the press takes to heat up. Small presses are usually quicker to warm up than larger ones and if you share the press with other people, this time saving may be important. Presses which take a long time to heat up also use more electricity and are consequently more expensive to run. When buying, make sure that any specifications given for warming up time refer to the time taken to heat the whole platen since the centre always tends to warm up more quickly than the edges.

If you want to mount your prints on a variety of materials of different thicknesses, you may need a press with a variable pressure facility. The pressure exerted by a mounting press is not to increase adhesion but to ensure that the mount and print are kept perfectly flat during the mounting process.

Tissues and tacking irons

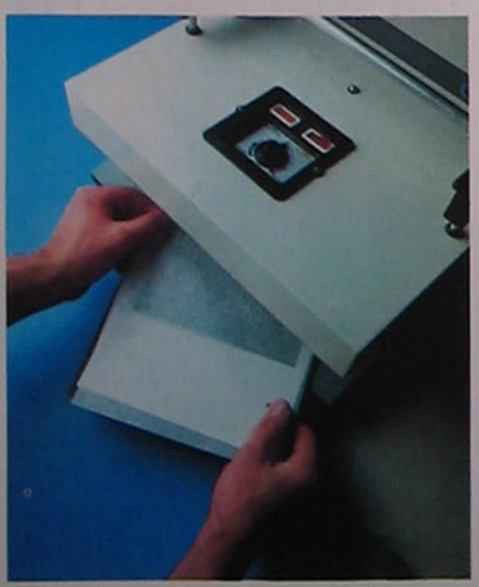
Mounting tissues for hot mounting can be bought in sheet or in roll form. The sheets range in size from about 9 × 12 cm to about 60 × 75 cm. Rolls come in widths of between about 520 mm and 1 m and contain lengths of between 25 and 250 m of tissue. Since it is easier to cut tissue down to size rather than add pieces together, it is usually better to buy larger rolls or sheets—though the largest are very expensive. Nevertheless you can mount larger prints using several small sheets—although any overlapping of tissues may create unsightly bumps on the finished print.

Tacking irons are electrically heated devices rather like soldering irons. They are used to attach a small area of the centre of the tissue to the print and the corners of the tissue to the mount. This allows you to trim prints, tissues and mounts together and ensures that the print cannot move during mounting.

The cheapest tacking irons have a small head—around 1.5 cm square. Better results can be obtained using irons with a larger head and with a built-in thermostat that gives control over the temperature of the head—if the tacking head gets too hot it could damage the print, particularly with RC paper.

Rather more expensive are Teflon

The technique of dry mounting



1 *Attach a piece of mounting tissue, the same size or slightly larger than the picture, to the back of the print by tacking it in the centre.*
2 *Next, trim the print to the required size so that the print and tissues are exactly the same size.*
3 *The print is attached to the mounting board by lifting the corners and tacking the tissues to the board. This prevents the print from moving when it is placed in the press. So if a prepared mount is used, it is vital that you place the print accurately.*
4 *Place the print in the press. It is a good idea to cover the print with a layer of paper, such as the paper which comes with the mounting tissue, to protect the surface from any dirt which may have got into the press.*
5 *The mounted print*

Dave King

Dave King

coated tacking irons. These solve the problem of hot shellac sticking to the iron head. But while this is useful the extra cost is rarely justified since the shellac which builds up on ordinary tacking irons can be removed simply by rubbing the head with sandpaper.

Trimmers and guillotines

The simplest type of tool for cutting and trimming prints, tissues and mounts is the guillotine. It is rather like an ordinary paper guillotine, consisting of a long blade, hinged at one end on to a board. If you want to mount your prints on to very thick card, you will almost certainly need the extra strength of a guillotine.

Trimming the print *Trimmers are useful for both mounting and darkroom work. The rotary trimmer (left) is the best general purpose type, but for cutting prints only, cheaper models which use fixed blades (right) are perfectly adequate*

Dave King

Another type of cutter, usually called a *desk trimmer*, has two long blades that act in a sort of scissors motion. Desk trimmers are fine for cutting through prints, tissues and thin mounting card but they may be defeated by thicker types of board.

Although both guillotines and desk trimmers can be fitted with guards to prevent accidents, the safest type of cutters for operation in the darkroom are *rotary* trimmers. These have a circular blade that runs along a long straight blade to cut the print. Most rotary trimmers can cut material a little thicker than a postcard and so are perfect for prints and tissues, cutting cleanly and giving good, straight edges and corners. Blades on rotary trimmers range in size between 25 cm and 130 cm. For most amateurs, a 40 cm blade is quite sufficient since prints are rarely likely to be much bigger than this.

When choosing any type of guillotine or trimmer it is worth looking for one which actually grips the material being cut. It can be infuriating if mounting card or valuable prints slip and are slashed by the cutting blade.

Mounting materials

Prints can be mounted on card of any type, but it is better to use card at least 0.5 mm thick—very thin card or paper tends to buckle under the heat from the press and may become bent and dog-eared if handled excessively. If you can afford it, the most convenient card to use is special mounting board which can be bought in most art and craft shops and in good stationers. It comes in a wide variety of colours and thicknesses. But any good quality card will do.

Tissue types *Mounting tissue can be bought in sheet and roll form and is available in a range of sizes*

Telephoto lenses

It is very useful to have lenses with focal lengths different to the 50 mm standard. But with shorter and longer focal lengths than this, it is often necessary to use special designs

Ed Buziak

Curved ruins *Fisheye lenses with their very short focal lengths are extreme examples of the retrofocus design*

The focal length of a lens is one of its most important features. Changing the focal length allows the photographer to control how much of a scene is included in the picture as focal length determines the size of the image. As focal length increases—to give a long focus lens—so does the image size, and this can be used to allow the photographer to fill the frame with the subject without having to get too close to it.

Unfortunately, as the focal length increases so does the physical length of the lens. Although the classical optical designs of achromatic doublet, triplet, symmetrical, Petzval or Double Gauss (see pages 1406 to 1407) can all be used, these designs produce lenses whose actual lengths are the same or longer than their focal lengths—a 300 mm lens would be over 300 mm long. Such long lenses are unwieldy and their extreme length leads to mechanical complications, particularly when it comes to providing a focusing mechanism.

The telephoto lens

To overcome this problem, the *telephoto* design was invented. Many people use the term telephoto to describe any lens longer than the standard, but that is technically inaccurate. A telephoto lens is one which has a positive front element and a negative rear element.

To understand how a telephoto works, it is essential to appreciate just why a long focal length gives a larger image. A slide projector provides a simple analogy. As you move the screen further away from the projector, the image spreads out more and more and becomes larger. In the same way, light passing through a lens with a long focal length converges more gradually and the image is focused further away from the lens. At the point where the image is focused, therefore, the image is spread out more and so is larger. So the further away from the lens that the image is brought to focus, the larger it is.

The advantage of the telephoto design is that it brings an equally large image to focus in a much shorter distance. This is achieved by placing a negative group of lenses between the normal positive group and the film plane. Because this negative rear group reduces the convergence produced by the positive front group, the combination gives the same gradual convergence of a lens placed much further from the film plane. So the telephoto gives a similar amount of image spreading and so an equally large image to a single lens group with a long focal length, but the front element is much closer to the film plane.

Indeed, a telephoto could give an image as big as that given by a 300 mm basic lens, even though the front element was only 200 mm away from the film plane. When a telephoto lens is described as having a focal length of 300 mm, therefore, it does not really mean that the lens is 300 mm from the film plane; it simply means, in practical terms, that the lens gives an image the same size as given by a non-telephoto 300 mm lens.

Another effect of telephotos is that, because the light from the front element is already converging when it reaches the rear element, the rear element can be smaller than with other designs. This makes the design and construction of the lens housing simpler as well as keeping to a minimum the diameter of the lens mounting.

The end result is that the lens is smaller than would be possible with other designs. This compression can be expressed as the *telephoto power*, which is the ratio of the focal length to the distance from the front element to the film, at infinity focus.

A negative lens was first used to give a telephoto effect by the astronomer Barlow as long ago as 1834. Barlow lenses are still widely sold in the form of teleconverters, which increase the focal length of normal lenses in the same way that the rear element of a telephoto lens acts on the front element or group.

Whereas the Barlow lens used a negative element with an existing lens, a lens invented by Dallmeyer in 189[illegible] was self-contained and so was the first true telephoto. Other early designs used variable separation of the two elements to give variable focal length as a form of primitive zoom, though image quality was very poor.

One frequent drawback of the telephoto design is that, because it is not symmetrical, it tends to suffer from distortion, particularly pincushion. When the telephoto power is high—that is in physically short long focal length lenses—this distortion can be especially severe. Fortunately, this has been overcome to a large extent

Sidney Ray

Curved lines *Telephotos tend to be non-symmetrical and so suffer from distortion*

in modern lenses by the use of extra correction elements. But in less powerful telephotos—in the order of one and a half to two—quite simple triplet and Double Gauss designs (see page 1435) are adequate, and these are frequently used in derived form with a negative rear group.

As always with refracting lenses of long focal length, the limit to performance is set by chromatic aberration. But the use of extra low dispersion (ED) glass gives better results and so allows larger apertures to be used while maintaining quality.

The retrofocus lens

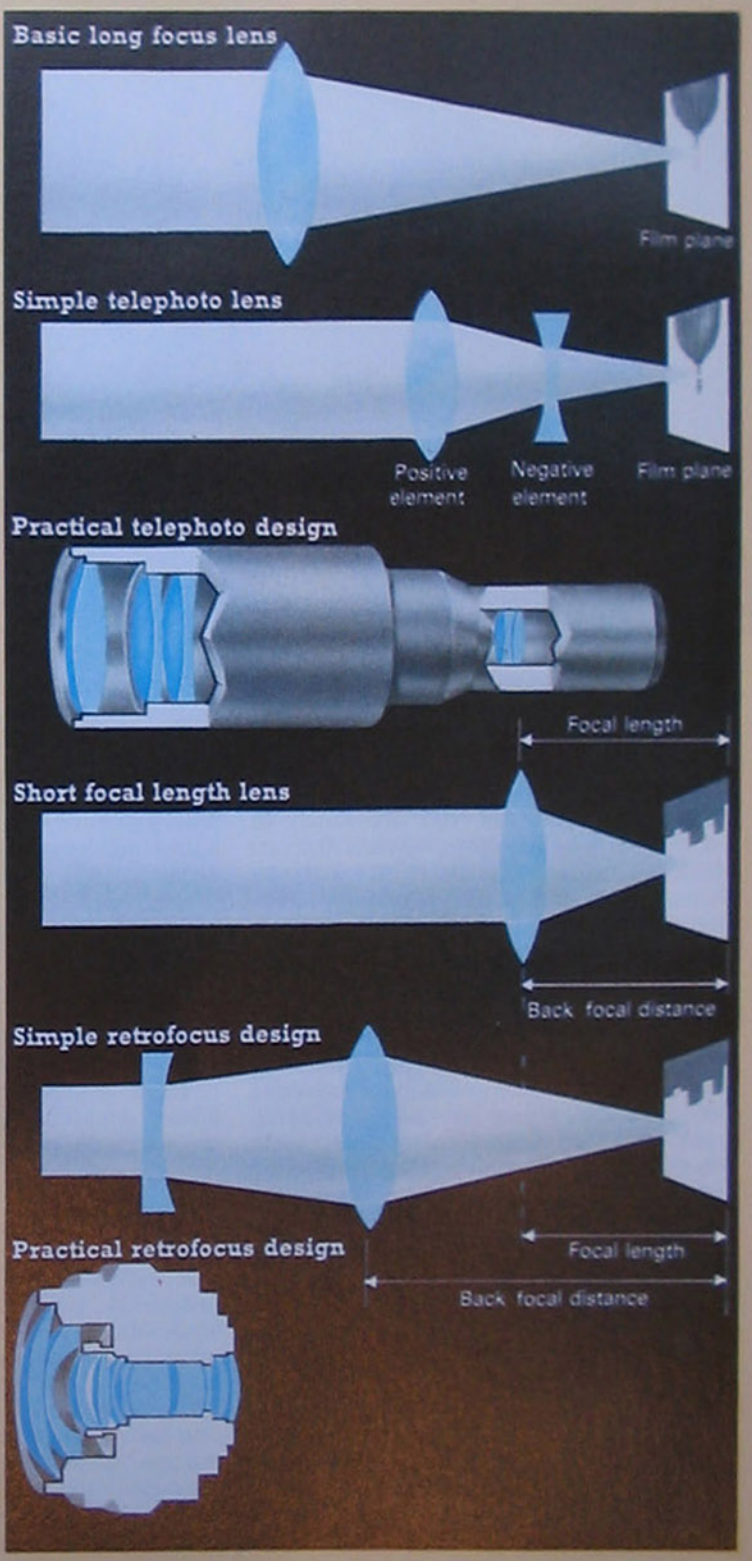
The telephoto principle is also used in a slightly different form to produce wide angle lenses. With conventional designs, such as symmetrical lenses, the short focal length necessary to give the required angle of view can cause problems. This is because the *back focal distance* (BFD)—the distance from the rear element to the film—is very short.

With direct vision cameras and large format monorail cameras this small clearance is usually no problem. But when an optical device, such as a reflex mirror or a beam splitter, is to be situated between the lens and film, the optical design of the lens must be changed to give a long BFD but keep the focal length short. In the case of a modern SLR camera, a BFD of about 45 to 50 mm is needed to allow for the mirror, though lenses with focal lengths of 20 mm and less are available.

This is the reverse of the needs of a telephoto lens, and the required effect is given by the *retrofocus* (also known as *reversed* or *inverted telephoto*) design.

The basic design consists of a negative front group of large diameter followed by a positive rear group of small diameter. The negative group forms a close virtual image of the subject which is then focused on to the film by the rear group. This design, while considerably increasing the size, weight and cost of the lens compared to an equivalent symmetrical design, has other advantages apart from the large BFD. For example, one effect of having a negative front element is to reduce the angle at which light from the edges of the field of view passes through the lens. This helps to reduce vignetting and so gives more even illumination at the edges of the frame (see page 1331). The negative group also reduces field curvature.

Due to the asymmetric design, early retrofocus lenses tended to suffer from barrel distortion. In most modern lenses improved optical glasses have reduced this to an almost unnoticeable level. Field angles up to 90 degrees or more are commonly available. Beyond about 110 degrees (as given by a 15 mm lens on the 35 mm format) correction of distortion becomes very difficult. If this is abandoned and severe barrel distortion permitted, then fisheye lenses with focal lengths down to 6 mm and field angles of up to 220 degrees are possible.

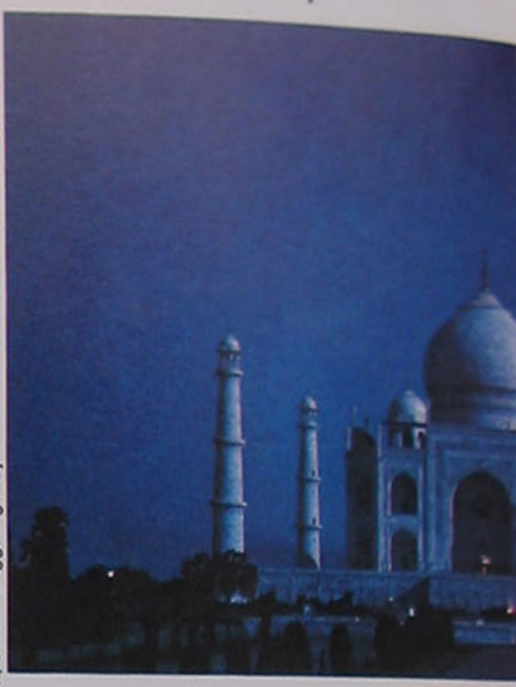


Lens layouts *Telephoto and retrofocus designs use extra elements to spread the light in various ways. In actual lenses the situation is complicated by the presence of more elements which are used to correct aberrations*

Creative approach

Monuments

Monuments are among the most photographed of subjects—so finding new ways of approaching them can be an exciting as well as difficult challenge. It helps if you know something of your subject's history



Adam Woolfitt/Susan Griggs Agency

Gargoyles at Notre Dame *Unusual foreground subjects can lead the eye towards or contrast with another building of a very different nature*

The term 'monument' does not refer only to something ancient and grandiose —almost any notable structure great or small of local or national importance falls into this category. The very diversity of subjects that you are likely to come across, therefore, means that no single approach can be right for every occasion. In fact just how you approach photographing monuments depends on what you want from the final images.

For example, you may simply want a record shot of the postcard type as a document of, perhaps, a quick visit to a certain place. This may involve showing the monument only as the focal point in a much wider scene. On the other hand, you may take a technical approach with the intention of showing the monument as accurately and with as much detail and clarity as possible. A further alternative, and often the most exciting approach, is to try and create an interesting and unusual image which draws upon your own very personal interpretation of the subject.

Most monuments have some sort of association, either historical or personal—they may have been built in honour, or commemoration, of a person or event, or simply as a form of expression. Because of this many are designed to attract the attention and therefore tend to be impressive or interesting enough in their own right to be worth a picture. But this basic attraction may draw the unwary photographer towards the mundane record shot. To get a more interesting picture you may find that thinking about the monument's association provides better clues to taking more interesting shots. Often, where the monument is particularly famous, you will already know why it was built and may have formed your own ideas on the subject. In such cases the idea for the picture may be preconceived or conjured up beforehand. But if you know little of the subject in hand, make a point of finding out about it before you start shooting. You may discover many new ways of approach that stem naturally from the subject and would not have occurred to you otherwise.

You can adapt your approach to suit the history of the monument. Gothic buildings, particularly cathedrals, with their tall spires and soaring arches, were often built to give the impression of man aspiring to the heavens. You can help the medieval architects by accentuating the height and grace of these buildings in your photograph. One way of doing this is to move in close to one of the spires and shoot upwards with a wide angle lens. With a vertical format to

Wailing Wall, Jerusalem *An attractive sky makes all the difference to the composition when the monument itself, although famous, is not beautiful*

Reflection, the Taj Mahal *Reflections can give an unusual view of a well known monument while people can add a splash of colour to an otherwise dull picture* **Taj Mahal** *A classic view is often best for a symmetrical building like this one, while moonlight lends a romantic touch*

John de Visser

D. Houston/Bruce Coleman Ltd.

avoid an over-solid base, the strongly converging verticals may seem to be soaring into the heavens. This approach may be particularly effective on a cloudy overcast day when the spire seems to be almost touching the sky. But another popular approach is to shoot with the narrowest aperture possible when the sun is right above the spire at midday, so that the spire is in silhouette and the top seems to burst with light—an effect exaggerated with a wide angle lens.

These are just a few of the approaches you can try out with Gothic buildings: there are, of course, many others. It is important to analyze just what is striking or beautiful in the monument and photograph it in such a way as to bring this out. A Moorish palace, for instance, often seems to exude a cool elegance which can sometimes be caught at its best very early on a sunny morning when the light is still slightly tinged with blue—particularly if you can include water in the shot and keep the composition very clean and simple. The most striking thing about a Greek temple, however, can often simply be the contrast with the blue sky. To show this to best effect try an almost abstract shot from a low viewpoint—perhaps with a telephoto—with the white stone of the temple shining in the midday sun contrasted against the sky. The possibilities are endless.

There is no reason why you should include the whole of the monument in your shots—very often details are more interesting than the whole. This is not only true of old buildings, but also of modern ones—some very successful shots have been taken of the tops of Art Deco skyscrapers showing the intricate pillars and window designs. You can often select details which sum up the style of the monument or the historical period which produced it—Egyptian designs or the sculpture at the tops of columns can often convey much more than a straightforward view of a monument. By concentrating on small but significant details you can use them as symbols to create powerful moods. An old castle may well have massive stone blocks showing interesting weather-beaten textures—by taking close ups of these you could convey the impressive scale of the castle walls better than by photographing the whole castle.

The opposite approach to this is to present a monument in its context. It is generally better to choose angles that keep people out of the frame, so choose a time of day when there are few people around, or fit a dark neutral density filter to make them 'disappear' (see page 344). But sometimes you need the people in the shot to give it some atmosphere. This is particularly obvious in situations where life around the monument has changed little for hundreds of years—the people can be as much a part of the monument as the structure itself. Usually though these people must be doing something positive rather than simply passing by—and they should be very obviously 'local' unless you wish to show the monument as a tourist attraction.

Often a monument contrasts strongly with its surroundings and this contrast may provide some interesting shots. For example, a rich mosque could be contrasted with the squalid hovels around it. A telephoto lens or a wide angle can both be used to do this. From

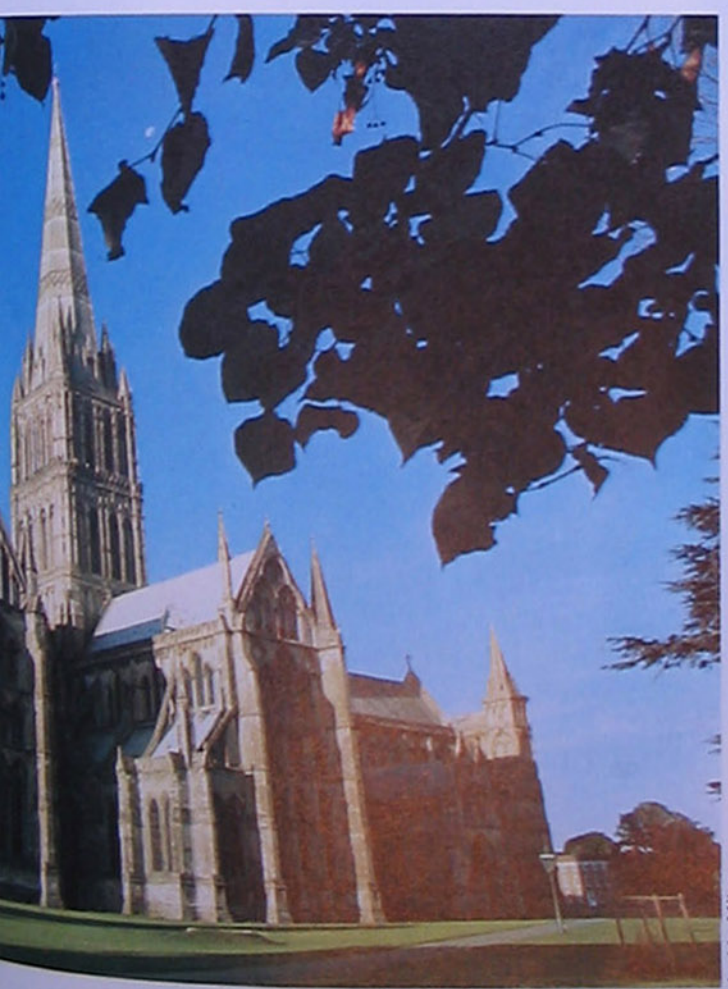
E. Bernager/Explorer

Richard Olivier/Xenon

Sacre Coeur, Paris *White buildings look very effective when seen against a blue sky. A well selected view can sometimes be much more expressive than the whole structure*
London Monument *With a telephoto lens you can compress space, a useful technique when you want to bring two contrasting buildings into juxtaposition*
Salisbury Cathedral *A careful composition with a wide angle lens allows verticals to converge in a way that is consistent with the style of architecture*
Athens at dusk *Many monuments look much more effective in semi silhouette, and the evening light is a useful way of obscuring untidy surroundings*
The Leaning Tower, Pisa *The unusual viewpoint of this famous tower not only gives a new look to the subject, but a dramatic idea of the way the tower leans over*

Adam Woolfitt/Susan Griggs Agency

Michael Freeman



Archie Miles

J. J. Guglielmi/Tony Stone Associates

a distance with a telephoto, the mosque can be made to appear to rise out of the mass of huts. By shooting from closer with a shorter lens, on the other hand, and including one of the huts in the foreground, you can make it appear to loom over the mosque.

Many ancient monuments in cities are surrounded by modern buildings which often tower over it and a building once regarded as grand can appear slightly ridiculous. You can emphasise this in your shot by keeping the monument small in the frame. You do not have to dwarf the monument to achieve the same effect—just by including an incongruous or very modern detail in the picture, you can emphasise how the atmosphere of the past has been destroyed by later developments. A shot of an ancient ruin reflected in the windows of a souvenir shop or a plate glass cafe in the foreground would be an example of this approach. In many countries, small plastic replicas of monuments are available—try juxtaposing the real monument with one of these.

You may not want to show the whole monument, but only a silhouette, or certain details, to give certain moods. Choose your lighting to hide or reveal certain details. If the texture of a monument—the roughness or smoothness of the stone—is attractive, shoot when the surface is illuminated by strong side lighting.

Some monuments can appear pale and colourless for most of the day, but you can use warm early morning or evening sunlight to add a colourful glow to the shot. This can be particularly effective late on a rather changeable day, when the sky behind the monument is a contrasting dull grey. Striking and unusual views can sometimes be achieved by shooting the reflection of the building in a puddle or a wet pavement. The warm light on the monument contrasts with the cold grey of the surroundings. Because so many monuments are photographed in bright sunlight, wet weather gives you the opportunity of presenting them out of context. Reflections and glistening surfaces can be used in a variety of ways, and very often, the poorer the weather, the more interesting pictures are.

Many monuments have an air of mystery, and if you want to accentuate this, try shooting in mist. Mist hides detail but adds mood—really thick mist might reveal nothing but the battlements of a ruined castle giving it a powerful presence.

Monuments are usually presented as grandiose, but there is no reason why they should occupy the greater part of the frame. Many interesting pictures of monuments concentrate on the sky, giving an impression of great space. A dramatic skyscape can emphasize the impressive isolation of a monument, but bear in mind that a bright and featureless sky is rarely interesting. Try to choose a sky with heavy clouds. When the sky is cloudless, graduated filters can darken an uninteresting sky, while leaving the lower part of the picture brighter. By combining a graduated filter with a warming filter such as one of the 81 series, you can take effective photographs of a monument under a brooding, copper-coloured sky. However, do not overdo this type of picture, or it may be too obviously artificial.

The Capitol, Washington *This stunning effect is produced simply by moving the zoom control while making a long exposure. Many buildings look much more glamorous at night, especially if they are floodlit so that they stand out against the dark sky.*

Selim Mosque in snow *Unusual weather conditions make all the difference to a building, and instead of intruding, a foreground figure adds a little local colour and atmosphere to the photograph*

Paul Keel/Explorer

World of photography

Robert Lebeck

Robert Lebeck is a photojournalist who has the ability to tackle any subject or assignment—from political coups to personal profiles, from football matches to family groups—anywhere and with very little notice

After more than 30 years as a photojournalist, Robert Lebeck is still at the top of his profession. As a staff photographer for one of world's best news picture magazines, *Stern*, he is working continually on one assignment after another and is constantly on the move. And yet despite this pressure he produces photographs of a consistently high standard.

The truth seems to be that he thrives on this high level of activity and needs the constant challenge to keep him on his toes.

Some years ago, in 1977, *GEO*, impressed by his editorial judgement, asked him to give up photography and take over as their editor in chief. Feeling that it was about time he did something new, he accepted.

'I had the idea that once you turned 50, you should change. Taking pictures is all right for young men, but I thought I should do something else.'

But he soon found that even this responsible position did not give him quite the level of excitement he needed.

'It was too easy, starting work at ten and leaving at six, with two hours for lunch. And I soon began thinking, "How can I go back to photography?"—there was no more travelling, no more challenge!' So after little more than 18 months with *GEO*, he went back into action full time as a photographer for *Stern*. 'Maybe it was just too early—maybe I should become an editor at 65!'

During his long and successful career, Lebeck has made an enormous number of photo essays, including 300 major features and so many smaller stories that he cannot count them any more. But though photography is now his life, Lebeck's interest in the subject developed almost by accident.

He was an anthropology student at Columbia university and had never used a camera before, when his wife gave him

Robert Lebeck

Robert Lebeck *A relaxed moment away from the pressures of picture taking*

Bangladesh hospital *(top) These men were partially blinded by vitamin deficiency. Lebeck's photo-story in 'Stern' helped to raise money for them*

Lalibela, Ethiopia *One of Lebeck's favourite places, this is the entrance to one of several ancient Coptic Christian churches carved from the rock*

one as a 23rd birthday present. He read the instructions and started using it. He soon took so many pictures and became so engrossed that he abruptly ended his studies and started taking photographs full time.

Although he had no definite plan to become a photojournalist, he was lucky enough to be on the spot three months later with his camera when a local news event took place. One of his shots was printed on the front page of the local Heidelberg newspaper and the paper began to commission him to do occasional assignments.

Then, a chance meeting with a French photographer travelling through Germany helped to give him an advantage over all the other photographers in town. This photographer taught Lebeck to process and print his own films and have them ready to deliver to the paper the same night. He was also shown how to use high speed film and push process it so that he could take pictures at night without flash. In this way, he managed to get the scoops other less enterprising photographers missed.

Otherwise self-taught, Lebeck learnt the techniques of photography simply by taking pictures. Good composition always came naturally. 'I've always seen in terms of the classic Golden Mean. Sometimes I even have to fight against it as I don't always like the way I compose. I was always interested in art. I think it must be in the family.'

Both his grandfathers were in the arts, one being an artist and the other a designer. When he spent time in New York while a student, he often wandered around from one art gallery to another. 'I was very influenced by the art there, and by *Life* and *Look* magazines. I didn't take pictures then, but I looked at so many paintings and photographs they must have had an impact on me later, back in Germany.'

After some time in Heidelberg, Lebeck got a job on a Hamburg-based news magazine. He was clearly beginning to make a name for himself and was soon given his first major assignment as a photojournalist. His brief was remarkably open—he was told by the magazine that he could cover anything he wanted. He chose West Africa, then not very familiar to the western world. The pictures he took during his three month stay were used by the magazine and later produced as a book. But, even more importantly for Lebeck, he had taken some pictures related to Zaire's movement for independence, which appeared in *Life* magazine and *Paris Match*. He now says that this was the most exciting moment of his whole career—the first time his work was used internationally after his first major assignment.

As a staff photographer, Lebeck has photographed a staggering range of subjects; he appreciates variety. In 1976, at Photokina, the international photography exhibition, he was included in a display of photographers the organizers called the 'Universalists'.

The term was used to describe those rare photographers who seem to photograph everything.

Stern for instance, has sent him to cover everything from the Bolshoi Ballet to the marriage of Franco, to demonstrations in Iran, where he took one of the few pictures showing Ayatollah Khomeni without his turban. Lebeck has also covered general news, like the Olympic Games, and has done studies on Russian cities and of countries such as Bali in Indonesia and Peru. He has taken both formal and intimate portraits of politicians like Golda Meir, Willy Brandt and Winston Churchill and of artists such as Salvador Dali and Alexander Calder.

One preference he does have is for photographing public figures because he enjoys meeting them. 'Someone who has a name didn't get it by chance. They are mostly very interesting people.'

He is always keen to show a new face to the personalities that he photographs. He likes to meet them, see how they live, then photograph them in their homes, relaxed. Instead of a formal portrait of a politician at his desk, he will photograph him at home, playing with his children. He photographed Willy Brandt, for instance, on holiday, and his favourite photographs of the King of Sweden show him running through the massive, statue-lined corridors of his castle.

Missionary
A 'beautiful contrast' appealed to Lebeck in this soccer crowd scene, taken in Togo, West Africa, in 1960 during his first major overseas assignment —an assignment that led to international recognition

Belfast woman
While walking through a poor district, Lebeck saw this woman— 'she was just standing there with the cross at the doorway of her house. I asked her to pose, of course.'

Bolshoi birthday
Lebeck asked if he could take this unusual view of Moscow from the roof of the Bolshoi theatre for its 200th anniversary

Of course, it is not always easy to achieve this intimacy. Public people are generally reticent about revealing their private lives to the media. On an assignment to photograph the immensely rich stock broker, Bernie Cornfeld, in Switzerland, he was lucky to get any shots at all. Lebeck's idea was to portray the extravagent life style of this extraordinarily rich man, but two other *Stern* photographers had already spent weeks trying to get the story.

When Lebeck went to see Cornfeld, he took along an issue of *Life* magazine and this did the trick. Even though he is German, Lebeck was the first photographer to take intimate pictures of Lyndon Johnson when he became president of the United States. When Lebeck showed these pictures to Cornfeld, the millionaire relented and gave Lebeck total cooperation. 'This man photographed the president of America', Cornfeld told his astonished staff. 'And now he's going to photograph me!'

Nevertheless, although Lebeck clearly enjoys photographing famous people, he does not want to do it all the time. 'I do it for a while, then I get fed up, so I change to sport—I am one of those photographers who will do almost any story. I hardly ever take pictures of football, but I don't mind doing it. I have never done fashion, but why not?'

Between assignments, Lebeck rarely takes pictures. 'I think you shouldn't take too many pictures because you can get

Robert Lebeck

Golf course frolics *This picture, which Lebeck took at a friend's wedding reception, was later 'faked' by an advertising agency who wanted to use it, but could not get the original from Lebeck as he was away on an assignment*

tired of it and you can only be good if you are enjoying yourself. If you are not having a good time you tend to come up with routine pictures.'

The assignments Lebeck has found the most difficult have been those in the Soviet Union. Although foreign countries always pose problems, the Soviet Union, where Lebeck has been ten times, poses the most. In the Soviet Union a photographer's movements are restricted and people are generally shy about being photographed. 'This difficulty makes working there even more satisfying, though, because if you get good pictures despite the difficulties, you feel even better.'

Only once did Lebeck find himself in serious trouble. While he was in Tashkent with a journalist, *Stern* ran a story on how badly Jews were being treated in

Fish and float *Another picture from Lebeck's first major overseas assignment in West Africa. 'They catch so much fish on this part of the Atlantic coast. As I walked up the beach, I saw this boy sitting on the day's catch, holding a float'*

'They need to be good. I always think about the magazine I'm working for and I always have the layout in mind.'

Stern pays all Lebeck's expenses including all his film and only the best hotels. 'It is a rich company, so they can afford the goodies.' They also provide a monthly salary, a car, a pension, a six week paid vacation, and 50 per cent of any sales of photographers' work to other magazines. Lebeck has never wanted to work freelance; he prefers the freedom of not having to rush back from assignments and the luxury of not having to count the days until a customer pays.

On an assignment of up to four weeks, Lebeck uses an average of five rolls of film a day. Before he leaves, he calculates how many films he will use and then takes twice as many just in case. On a single day assignment, however, he uses up to 20 rolls.

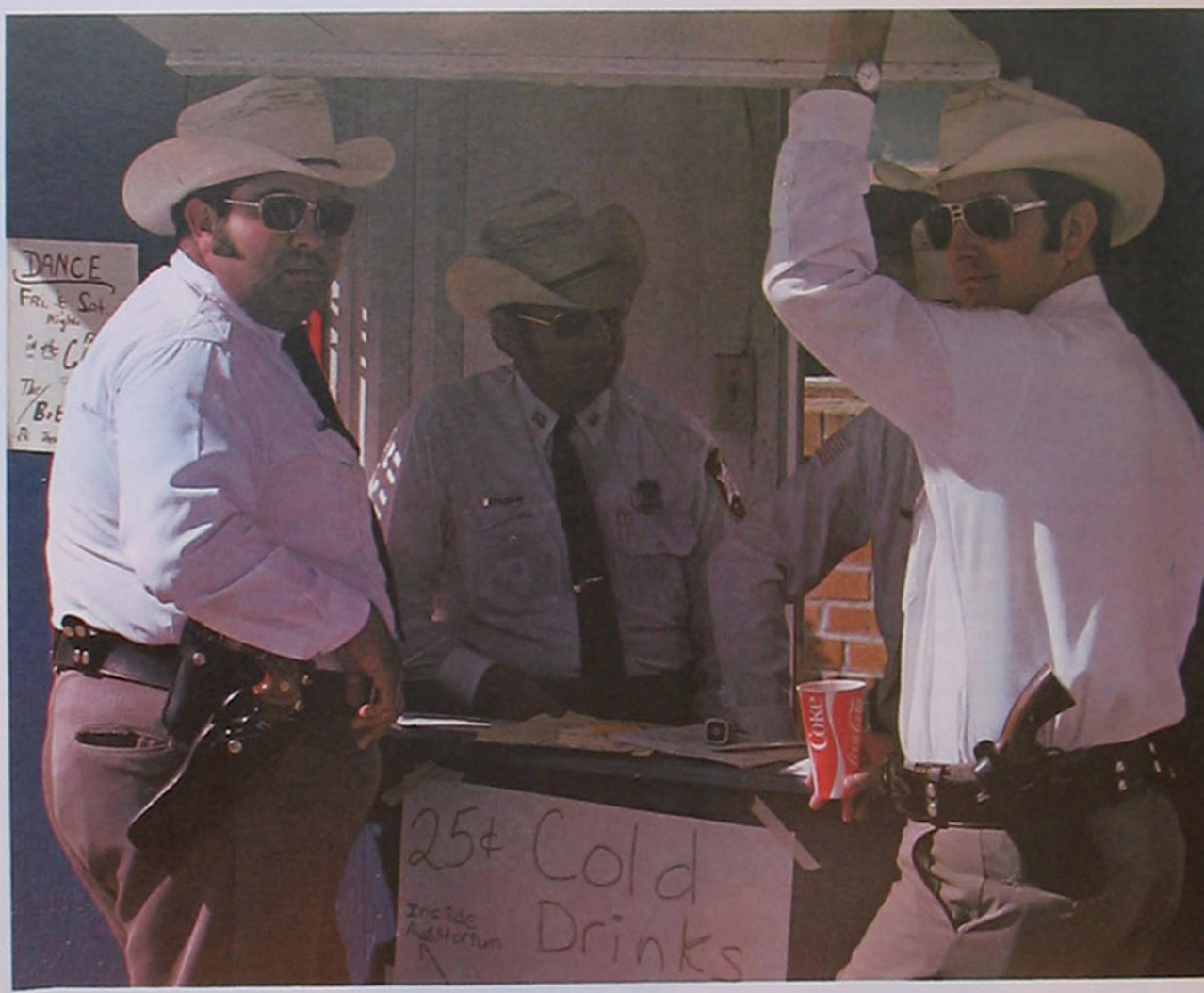
Lebeck uses Nikon FE cameras. He likes them because they are compact, light, cheap and give aperture priority automatic exposure (see page 200). He mostly works with one or two cameras and two lenses—a 24 mm and a 85 mm, both with apertures of *f*/2. He describes the 24 mm as 'the journalist's lens' and it is the one he uses most often, though he uses an 85 mm for portraits. He also carries a 135, 18 and 35 mm *f*/1.4 and the micro 55 mm.

Remarkably, Lebeck now works almost entirely with his cameras set on automatic, adjusting the setting only if he is shooting against the sun. 'Usually it's much better on automatic. You don't have to think about it. It's much faster and you can concentrate on the subject.'

He uses no special equipment when shooting sport, other than a motor drive for sequences that cannot be repeated. He does not even use a flash very often. 'If I can see, I can take pictures.'

He solves many technical problems before they ever arise—by carrying spares. For example, when he does plan to use flash, he takes two flash guns, as well as four flash leads since these often malfunction. He also takes spare batteries, three camera bodies—two to use and one spare—two pairs of spectacles, credit cards of all kinds and two passports (with a third kept at the *Stern* office). While travelling, Lebeck is very careful with his cameras, holding them when a plane is taking off or landing, and never putting them in the boot of a car, for example, but carrying them with him in the car.

All this equipment is kept permanently packed and ready to go at all times, in a discreet black briefcase that Lebeck keeps by the door of his office at home. When necessary, he can leave for an assignment at literally a moment's notice, which rather clearly sums up his attitude to photography and his work—he is ready to tackle anything at any time, in any place.



Texas *Much of the skill of a photojournalist is in capturing scenes that sum up a situation or location succinctly*

Robert Lebeck

the Soviet Union. Naturally, the authorities were upset and had a grudge against anyone employed by the magazine. 'A car came rushing up to where we were standing in the street. We were pushed into it, even sat upon, and taken to the police station. We were charged with espionage and they looked all through our equipment, taking everything apart. They took all the film and put us on the next flight back to Moscow and from there on the next plane home.' Fortunately, this kind of excitement is rare.

Lebeck likes to spend as short a time as possible on stories—which could be why he has done so many. 'I don't like to wait around, and I don't like to take too much time.' Often he will concentrate on taking only two or three pictures.

Improve your technique

Seeing double

Two pictures are better than one—but only if they are taken from points a few centimetres apart. Photographs taken like this can give a remarkable 3D effect when we view them with both eyes

Robinson/Brown

However clever the photographer is at exploiting perspective and visual clues to depth (see page 1278), there is no getting away from the fact that a photograph is two dimensional—or so it seems. But with two slightly different views of the same scene—a *stereo pair*—you can create a convincing illusion of depth using very simple techniques.

The camera sees the world from a single viewpoint, but our eyes form two separate images, each slightly different. These differences are 'decoded' by the brain, and interpreted as depth, so that we see the world in three dimensions. A stereo pair, by showing slightly different views, creates an illusion that is interpreted by the brain as depth. If we look at stereo pairs in such a way that each eye sees only one of the two, we can produce photographs which spring to life with remarkable realism.

The difference between the images that we see through each of our eyes is caused by their separation—usually about 65 mm. To reproduce these differences on film, we need to be able to take two pictures from viewpoints separated by a similar distance.

There are two major ways of achieving this separation. The simplest is to take two pictures in sequence, moving the camera between exposures. This method requires no special equipment, but is only suitable for static subjects. If the subject is moving, it is necessary to make the two exposures simultaneously. This can be done by using two linked cameras, a special camera with two lenses, or a conventional camera with a beam-splitter attachment.

Sequential exposures

The simplest way to take stereo pairs is to hand-hold the camera, and make a calculated guess about how far to move it between exposures. This is called *sequential* exposure.

Stand with your feet slightly apart, and take most of the weight of your body on one foot, before pressing the shutter for the first exposure. Then transfer your weight to the other foot, and make the second exposure. This should produce just sufficient stereo separation.

This may sound rather unreliable, but it is exactly the same technique as was used by the Apollo astronauts on the surface of the moon. Its lack of sophistication is more than compensated for by its convenience.

For good results using this and the more elaborate methods, certain precautions are essential. It is important that the same part of the subject is centred in the viewfinder for both pictures, and that the camera is held at the same height and angle. Any distortion that is present is more obvious in stereo pictures than in conventional ones, and for this reason, it is better to use a standard, or slightly longer focal length lens to minimize distortion.

Use the smallest aperture that you can, because out of focus areas look very objectionable when viewed stereoscopically. Grain looks very odd as well, so use the finest grain film that is practical in the circumstances.

Avoid scenes with heavy shadow areas if possible, because the shadows may reduce the feeling of realism. High contrast pictures also look unnatural in stereo, but pictures which would normally be dismissed as lacking contrast often look perfectly normal when viewed as stereo pairs. Aim to produce as much detail as possible in all parts of the picture.

Concentrate the most interesting part of the subject in the foreground, but no closer than about one and a half metres to the camera. Subjects closer than this appear so widely separated in the final

Johnson Collection

Stereo viewers *Essential for slides and a great help for prints, stereo viewers make it a great deal easier to combine the two stereo images*

pictures that the eyes cannot interpret them properly, while extremely distant subjects appear to have little depth.

Sequential stereo photography is made easier by using a tripod and some sort of slide mechanism, which then allows the camera to be moved the necessary distance without changing its alignment or direction. The focus slides which are designed for use with bellows are ideal, because they are usually have calibrations in millimetres marked on them and this helps to accurately set the stereo separation (page 406).

Simultaneous exposures

If you have two identical cameras, or can borrow a second camera that has the same focal length lens as your own, you can make both exposures at the same moment. This is very much easier if the two cameras are mounted on the same tripod, or on a bracket for hand-holding.

The bracket need not be particularly sophisticated, and could easily be put together from scraps of timber or metal. It should hold the cameras rigidly together, with the centres of the lenses about 65 mm apart. The shutter release can be linked by a bar so that both are pressed at once, or a double cable release can be used to coordinate the moment of exposure.

In the past, many specially designed stereo cameras have been available. They had linked lenses and shutters, and the apertures were specially calibrated to be perfectly matched. Only a few models are still manufactured, but secondhand stereo cameras can often be bought very cheaply.

A few camera manufacturers, notably Pentax, make a special accessory for stereo photography. This is a beam splitter that is screwed to the front of the camera lens. It uses front-silvered mirrors and a prism to produce a stereo pair on a single frame of 35 mm film. Some of these attachments can also be used for viewing the image.

3D—the future

Stereo photography used to be more popular than it is today, but it seems likely that it will soon enjoy a resurgence of interest. Two recent developments may well revolutionize the field. The first is 'Holography', a sophisticated technology which produces remarkably lifelike images in 3D. Holograms need expensive equipment and enormous care in the making, but a good one is quite unlike any other kind of photograph.

To see the depth in a hologram, you need no special viewer, and the effect is rather similar to that of looking through a window at the original object. Unfortunately, however, there are a few limitations to the process: the plates that are used are very insensitive, and it is presently difficult to photograph moving objects directly. Holograms in true colour are not at present possible either, but both these obstacles may be removed by research. A subsequent article deals with the development of holography in more depth.

The other development is likely to affect the amateur photographer more profoundly. It is a camera now manufactured by the Nimslo corporation, and it has four similar lenses mounted in a row on the front, and takes four images side by side on conventional 35 mm colour negative film. The camera is a non-reflex automatic model, and works well in conditions which also suit conventional point-and-shoot counterparts. Apart from the camera's unusual appearance, the main departure from conventional photography is in the printing of the pictures. After processing, the images from the four negatives are computer processed, and printed in narrow strips on a special paper. The surface of this is embossed with tiny lenticular prisms, which present each of the viewer's eyes with the appropriate image, thereby giving an illusion of three dimensions. No special viewer is needed to look at the pictures, and the only limitation is that the film must be processed by the camera's manufacturer.

3D souvenir *In Victorian times, stereo photography enjoyed a surge of popularity, and card mounted pairs like this often turn up in antique shops*

Viewing stereo pairs

Either negative or slide film can be used for taking stereo photographs, but unless you want to project the images, prints are probably more convenient to look at. For technical reasons, they should be no wider than about 65 mm, and should ideally be mounted side by side on card, so that the picture taken with the camera on the left is mounted on the left, and the right hand image on the right.

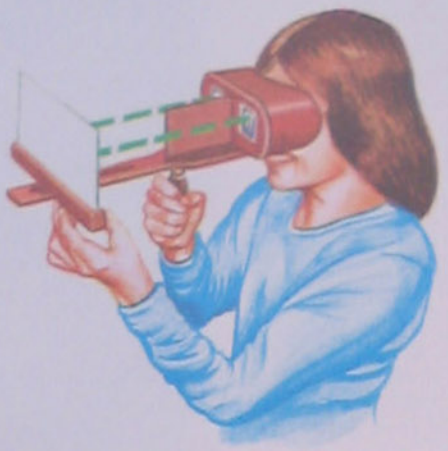
It is possible, with practice, to view stereo pairs directly. Place them on an evenly illuminated surface, and view them from about 30 cm away. Allow your eyes to relax so that instead of seeing two images, you see three. The central one of the three is in stereo. You may find that placing a piece of card between the two pictures helps you to fuse them into one.

Many people have difficulty in viewing prints this way and find it easier to print one of the images in reverse, then view the pair using a mirror. This simultaneously creates a barrier between the two pictures so that each eye sees only one of them, and brings the reversed print back to normal. The pictures accompanying this article have been reproduced for this method of viewing.

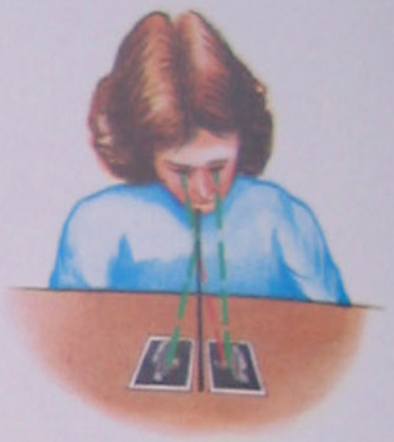
Many different designs of viewers used to be available at times when

Viewing stereo pictures

Viewing in stereo *To see depth in a stereo pair, each of our eyes must only see one of the two pictures. The left eye sees the image taken by the left hand lens, and vice versa*



Holmes viewer *The old-fashioned wooden viewers achieve 3D by using two lenses which bring the pictures into focus, and a panel which stops each eye from seeing the other picture*

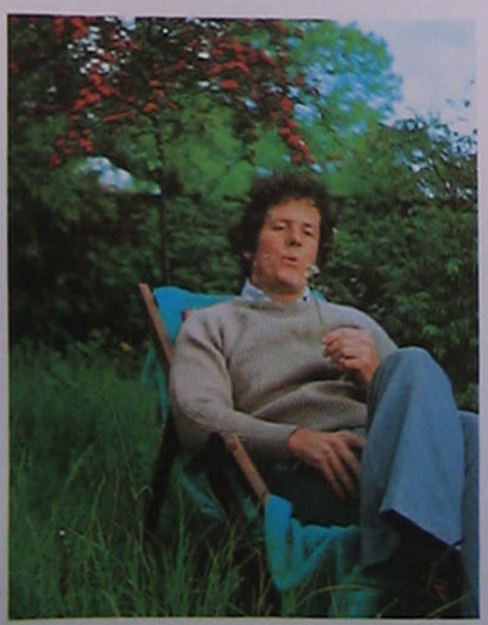


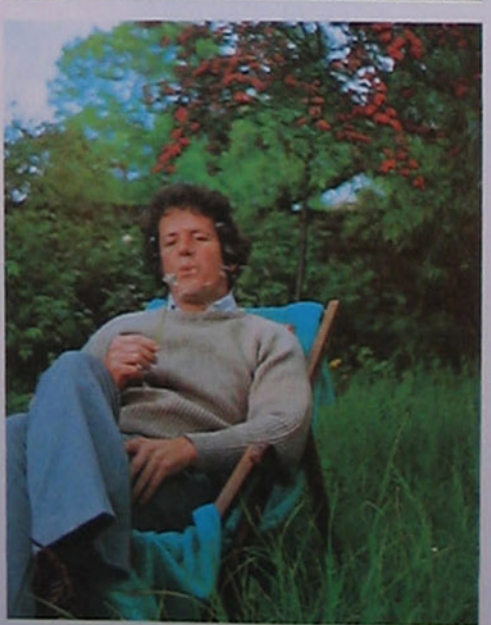
Using a mirror *You can see depth in the pictures below without a viewer if you look at the left hand image of the pair through an ordinary mirror, but you need a little practice*

Jerry Banks

Tapdance

Stereo subjects *Even the most mundane scene can make quite an interesting picture in stereo. A static subject can be shot twice with the same camera, but moving ones need special apparatus*





Tapdance

stereo photography enjoyed greater popularity than it does today. A few of these are still produced, and others turn up on the secondhand market very frequently. Most of them use two magnifying lenses, and have some device to prevent the left eye from seeing the right hand image, and vice versa. Practically any sort of viewer makes it simple to form a stereo image from the two halves of the pair, and a few companies still make viewers, usually out of plastic.

Colour transparencies can be viewed in a similar way to prints, but the lighting requirements are different, and 35 mm transparencies generally need some enlargement. This makes a viewer essential. However, transparencies have the advantage that they can be projected so that a group of people can view them simultaneously.

This in itself presents problems, because each member of the audience must see the left hand image with their left eye, and the right hand image with their right eye. Many solutions to the problem have been tried in the past, but the only practical one is to use two projectors to superimpose the two images on a special metallic screen. The two lenses are then covered by pieces of polarizing material, with the planes of polarization at right angles to each other. Everyone in the room wears polarizing spectacles, with the planes of polarization matching those of the projection lenses. Thus each eye sees only the appropriate image.

Although this system is by far the

Robinson/Brown/Beam splitter courtesy of Pentax

Beam splitter *For moving subjects, you must either use a special stereo camera, or one of these beam splitter accessories. They fit on to the front of a standard lens, and produce two vertical format pictures side by side on a conventional 35 mm frame. A matching viewer unites the images*

At the other end of the scale, if you have access to a telescope, you may be interested in taking stereo pictures of the moon. The movement of the earth provides the separation in this case, and exposures must be several hours apart.

Although this technique requires special equipment, many stereo techniques are very simple and encourage experiments. Indeed, the beauty of stereo photography is that it is so straightforward, and is a simple way of adding an extra dimension to your pictures. No special equipment is really necessary, and additional expense only adds polish and ease of viewing to your stereo photographs.

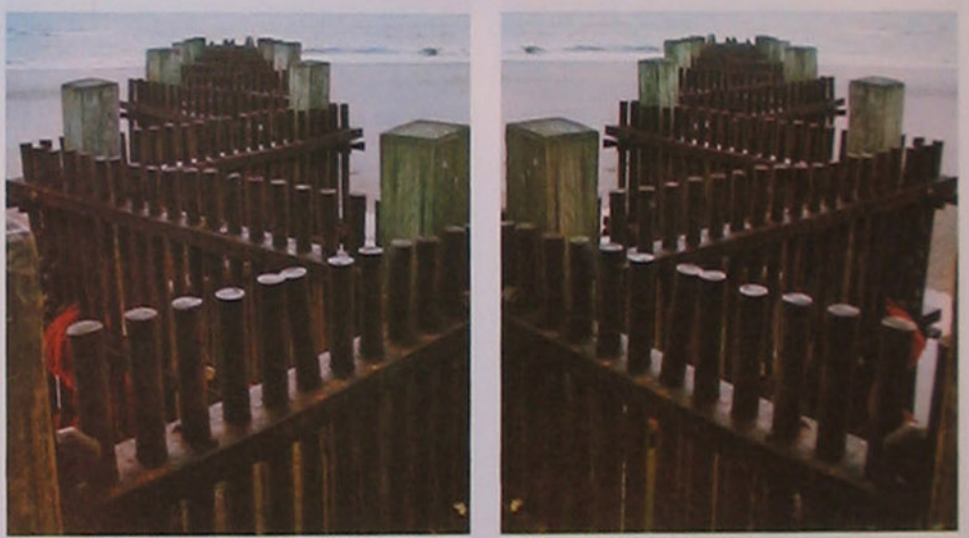
simplest, it has certain drawbacks. The polarizing filters cause a considerable light loss—about four stops—so the screen image is very dim. If the audience tilt their heads, the polaroid sheets cease be perfectly crossed, and each eye sees both images, causing eyestrain over long periods. For these reasons, stereo projection has never enjoyed great popularity, and the simple viewing of prints remains more practical.

Special techniques

When an object is very distant, each of our eyes receives an almost identical image, and we see very little depth in such a scene. Stereo photography offers the opportunity to enhance this feeling of depth, by increasing the distance between the points from which the two pictures of the stereo pair are taken. As a rough guide, the separation should be 1/50 of the distance to the closest object.

You could, for instance, photograph the view from the top of a high building. By taking two pictures from opposite corners on the same side of the building, you can make a stereo pair that shows each distant detail in dramatic relief. The impression produced on looking at the prints is similar to that of looking down on a model of the same scene.

Another application of this technique is stereo photography from the air. This is widely used for map making (see page 1022), but even a conventional passenger aircraft can be used to take oblique stereo photographs. The stereo separation is produced by the movement of the aircraft, but since this is so quick, a fast shutter speed has to be used, and the time that elapses between exposures must be very short. At average altitudes and speeds, no more than a second should elapse between exposures.



Tapdance

Tapdance

Patterns and composites

Multiple printing techniques can add a new dimension to your creative print making—yet require little more than your existing print making skills

By employing various multiple printing techniques, it is possible to produce many interesting pattern pictures. The strength of these pictures is all in the pattern, so it is best to choose a fairly simple image for maximum effect.

Multiple printing of a single image can take one of several forms. First, you can arrange to print a series of the same image in a horizontal, vertical, circular or random pattern. Or you can make individual prints, cut these to shape, arrange them and photograph the result with the enlarger or a camera.

If you decide to make a number of images on a single piece of paper, start by making a test print to determine the correct exposure for each individual printing of the image. Use the basic component of the image as the basis for a tracing, and then use this tracing to plan a pattern to your liking. Mark this pattern, using the tracing, on to a thin sheet of card or paper and use this in printing to locate the easel accurately.

To print the pattern picture, start by lining up the projected image with one end of the traced pattern. Replace the tracing with a sheet of printing paper and make the first exposure. Then place the pattern tracing on the paper on the easel again and, using the red swing filter (if you are using black and white material), align the image with the second part of the pattern by moving the easel. Remove the pattern tracing and proceed with the second exposure, and continue the procedure for remaining printings of the image.

If you are working with colour material —or have an awkard image which needs elaborate masking at easel level—the printing paper or film must be returned after each exposure to a light-tight paper safe.

The technique works well only if you can reposition the paper accurately each time, although this may not be important for well separated image printings. Be careful to keep the partly exposed paper correctly oriented during exposure and storage or you will destroy the regularity of the pattern.

Monique Fay/Suzanne Fields and Associates

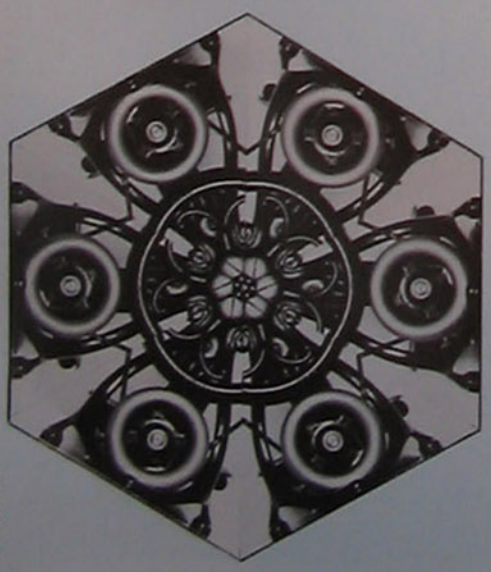
Circular patterns

Particularly effective patterns can be created by printing an image several times at intervals around a common point, in a circular pattern. One of the simplest ways of doing this is to pin a sheet of paper at its centre and simply rotate it the required amount after each image printing, again working from a pattern tracing if uniformity is required.

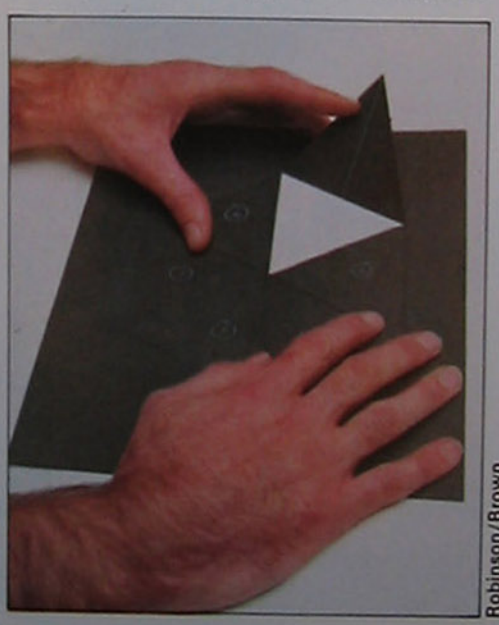
One obvious problem with this method is the small pin-prick which results, although it may be possible to conceal this if you make a copy of the final print. You must also provide a suitable pin board to protect the easel.

The best method, however, is to rely entirely on a tracing. If your enlarger easel does not enable precise re-positioning of paper, replace it with a board of suitable size and temporarily mount the printing paper flat on this—under safelighting, of course. Then align the board, with paper attached, with the aid of a pattern tracing. This can be hinged with pins to fold down over the print, each time in perfect register, and fold out of the way during each of the exposures.

Kaleidoscope effect *This pattern picture is formed by six printings of the same image. Cut a special mask from thin black card, and expose one segment at a time, keeping the mask still*



Mari Mahr



Robinson/Brown

Reversed images

If pattern pictures appeal to you, reversed image printing is yet another option you can use. The technique can be used to print adjacent but mirrored images and differs from the other methods of pattern printing in that you must remove and invert the negative for one or more of the image printings. Again, tracings are important for accurate pattern work and you should use a test print of the image as the basis for your design.

You must take special care when changing over the negative to keep the enlarger lamp switched off, otherwise you risk fogging any paper not put away safely.

Because the effect relies on the closeness of two seemingly identical but mirror images, you may find that

Mirror pattern *You can obtain pictures like this by mounting together normal and reversed-image prints or several duplicate transparencies*

masking off unwanted detail in the negative is difficult with all but the simplest of images. The only solution is to use a precisely cut mask placed on the print. This can be aligned using the pattern tracing, once the paper itself has been properly aligned.

Cut and paste patterns

Unless you take great care when printing, pattern pictures can be ruined —the slightest mistake can look very conspicuous in an otherwise perfect print. But you can ensure perfect results by copying a pattern made by making a number of separate prints, cutting these up and pasting them carefully on to a plain background. If you use non-permanent glue, the images can be re-arranged in other patterns, and each arrangement can be photographed or copied using your enlarger (see pages 1121 to 1123).

If you are making a continuous tone copy of the original, be especially careful with lighting, and use a sharp scalpel blade to make cuts that are as neat as possible. High contrast copies, such as on lith, require less attention to the physical nature of the montage, but use liberal amounts of white or black process paint—poster paint will do—to touch up details both in the original and in the copy negative before a final print is made.

Component pictures

These printing techniques can be adapted for printing a picture made with simple components from various shots. Silhouettes of a woman, standing and walking, could, for example, be matched to an image of a chair also in silhouette—and from the simple juxtaposition of the images you could develop a small sequence of poses depicting, in various 'frames', movement of the woman away from the chair.

Component pictures take a slightly different form if you shoot individual photographs specifically for combining in this way. The final image, effectively a montage rather than a true combination print, clearly shows that separate exposures were used but you can see the whole subject as one. For example, suppose you are using a 200 mm lens to photograph, from the same spot, small details of the side of a large building. Make a small print from each frame and use these separate images to form a composite image of the whole side of the building. This arrangement—which, incidentally, can look all the better for a staggered, 'fractured' look—can be stuck down or kept flat with glass ready for copying.

A further, more refined use of this technique is in producing and printing panoramas. For the original photographs, a fairly long lens gives much more natural perspective. Unfortunately, this gives many more separate images for a particular panorama than a very wide lens, and this means that many more prints have to be joined together, but the final picture generally looks much better.

There are two special problems with panoramas. First, every shot must be

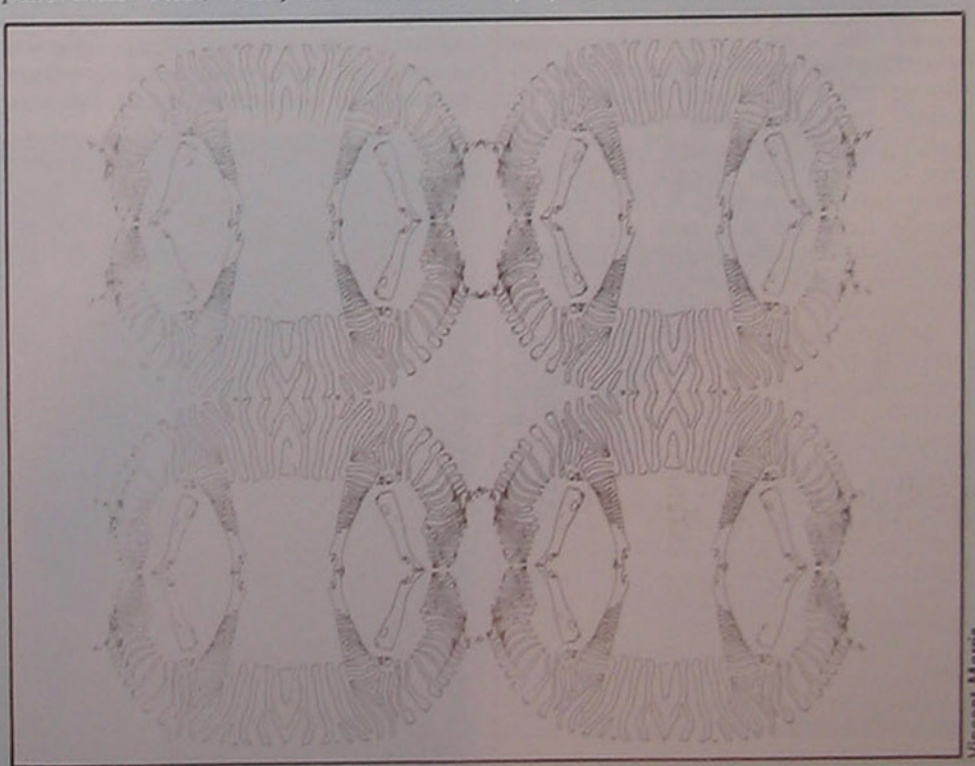
Graham Tucker

Judder effect *Double images can be created during printing, or by combining a duplicate slide with the original—but be careful with your choice of original*

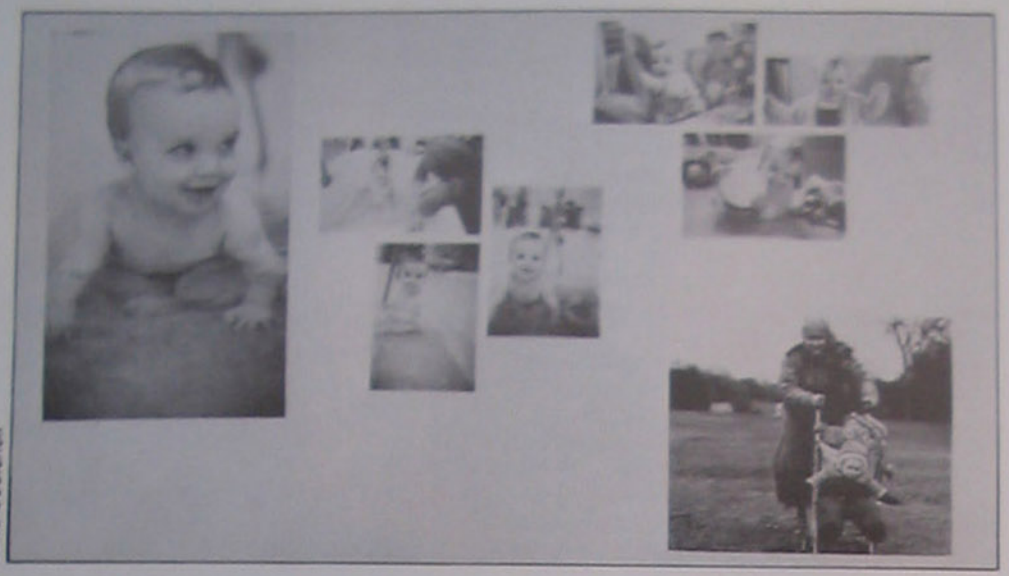
exposed and printed in exactly the same way to ensure that there is no discernible change in the image quality between one print and another. So you must take special precautions to base print exposure on full development time. If possible, process the whole batch of prints together to minimize further possible variations caused by a temperature drop or the exhaustion of solutions.

Second, it is not always easy to join up each of the prints perfectly. The original

Multiple image pattern *Sixteen separate prints from a solarized original were mounted together. The joins were opaqued in the lith copy*



Vincent Morris



Clive Bournell

Composite print *To create the effect of a magazine pictorial, try printing a composite around one theme. All these images were printed, with enlarger masking only, on a single sheet of paper*

photographs should overlap slightly as far as field of view is concerned, leaving a common area when two prints are compared. It is here that the join must lie. Temporarily stick down both prints and cut through this common overlap with a fresh scalpel blade, running the cut line along any very straight-line detail if you have a choice. Elsewhere, disguise the cut as best you can. This is fairly easy where the photographs show vegetation, but it can be difficult to conceal the join in even-toned areas such as the sky.

The real secret is to take great care over the cut. In theory, after you have cut along the common overlap, the offcut from each edge can be removed by flipping up the edge of the topmost print. This edge can then be stuck down to occupy the space formerly taken by the offcut. To avoid any displacement, the scalpel blade cut must be made perfectly vertical—avoid angled cuts at all costs.

You may find it better to stick down or mount the lower prints first. This simplifies correct alignment of horizontals in the picture, and makes cutting easier. The lower prints in a three print panorama are the outside two, leaving one print in the middle to position temporarily for cutting. A four print set should have the first and third as the lower prints; a five print set should have the first, third and fifth prints as the lower prints.

As you gain experience of montage work in general—and panorama printing in particular—you will devise your own working methods based on these general outlines. For instance, some people prefer to use temporary fixings at all times, simply rephotographing the final arrangement, whereas others find double-sided tape indispensable for sticking down edges as cuts are made.

Composites

Separate but related images can be printed on to a single sheet of paper to produce what is known as a *composite print*. You can make a composite print on a single piece of printing paper using many of the techniques of pattern printing or, if you prefer, you can make separate prints and trim and mount these to be rephotographed. Composite prints are distinct from combination or multiple prints in that they show many different views of the same basic subject—such as a portrait made from various profile and full face shots.

If you decide to attempt a composite on a single print, first choose a group of pictures of related interest, and broadly plan how to put them together. Composites look much better if irrelevant detail in each of the pictures is removed. This tight cropping produces a variety of shapes which serves to heighten the effect of a composite if the arrangement can be pieced together successfully.

Some of the pictures may have to be made at a different enlargement from the others, and test prints are therefore essential for each variation or you risk spoiling the whole print during the main exposure. These test prints can be used to make an accurate tracing to help you position the easel correctly for each individual exposure, in the same way as for pattern printing.

Proper masking is essential in composite printing. If your enlarger's negative carrier has built-in masks, these are normally adequate—simply mask off the image you do not want according to your tracing, once the negative image has been adjusted to its correct degree of enlargement. Unfortunately the mask leaves a soft edge where it appears on the print, although the severity of this varies with the degree of enlargement and tends to detract from the true sharpness of the print images.

You may find it better to produce a card mask with window cut outs shaped to suit the individual pictures of the composite. Take special care to cut the window apertures clearly as any bad cuts show up in the final print. Use white, but opaque card for this so you can clearly see what you are doing; and base your cutting on the tracing. Use card offcuts to mask off windows until that part of the print is to be exposed —tape them into position to prevent them slipping. To keep the mask flat on the print, put a sheet of cleaned glass placed on top. For portrait composites, this mask can be used to form vignettes within the area of the print. To soften the edge of the vignette, try raising the mask off the print surface, perhaps by using a jig (see page 224).

Split images

Another way in which you can create a special effect by careful knifework is to cut a print into strips of, say, 10 mm wide and offset all or some of these strips to

Development effects *Alongside the normal print shown below is another which was selectively 'stroked' with a swab loaded with concentrated developer and then briefly developed*

form a fractured image. But you must choose your subject with care—portraits are ideal, but abstracts less so because the result tends to look confusing.

For a portrait, use the following procedure. Tape along the top and the bottom using double-sided tape, and mount the print on a suitable cutting board. Using a steel rule and a sharp scalpel, cut strips from top to bottom, only severing the print from the mount when all strips have been cut.

Then re-arrange these strips in whatever manner you choose. You could leave large or small gaps between the strips, offset one or more of the strips so the image is laterally disjointed as well, and even intersperse the strips with others from a different print. Make a copy of the final image, so the actual cut marks are less evident.

Streaks and blurs

By moving either the paper or the enlarger during exposure it is possible to create streaks or blurs to convey movement in the subject. For example, a succession of after-images can be used to create a strobe effect. Simply make one full exposure to give one image its proper density. Carefully move the easel a small amount and then print the image again but at, perhaps, a quarter of the original exposure. This forms the first, faint after-image. Move the easel again and this time repeat the image at perhaps a fifth of the original exposure. This forms the second, even weaker after-image. Continue this procedure until the image has faded out satisfactorily.

If, instead of adopting this 'step and repeat' procedure, you make just the full exposure but near to the end of this gradually move the paper in the direction of movement, a streak is formed. This can be made to tail off by speeding up the movement of the paper near the end of the overall exposure.

Using the enlarger, you can create a zooming effect by first printing the main image, then surrounding (or overprinting) this with the same image at different enlargements to produce a multiple image print. By using a step and repeat procedure, sharp results are possible; by slipping focus, the picture is blurred. But unless you use a central mask on successive exposures, detail is likely to become obscured after a succession of images have been printed.

Exposure, with any of these methods, can be established only by trial and error but be especially careful with the cumulative effect when printing zooming effect pictures with the enlarger if masks are not used.

Choosing the right subject

The success of all these printing techniques relies on the use of suitable—above all simple—images, particularly where pattern printing is concerned. Multiple printing, even if masks are used, poses one particular problem: the effect of successive exposures where an image is allowed to overlap. And, unless you are especially careful, this can turn areas of the print you thought would be white into dark shades of grey, and this can ruin the effect you are after.

If you are printing from negatives, it is best to use simple, bold shapes on a white background. If you are printing on reversal material, use subjects on black backgrounds.

If you cannot shoot subjects specifically to try out the techniques mentioned here, you may be able to produce suitable images from existing slides and negatives by making lith copies. These can be easily worked on to produce the necessary clear backgrounds. In addition, you may prefer to use lith instead of conventional print materials and produce your special effects directly on this easily retouched material. Images can be cut, shaped, taped and touched up—and all you then need is a contact copy. But whatever method you use, the key to success with this type of print is meticulous care at every stage.

Clive Boursnell

Enlarger attachments

A considerable number of effects can be created during the actual printing stage by fitting camera lens attachments, like special effects filters, to the enlarger lens. One manufacturer has even gone as far as introducing a special enlarger lens series which accepts special modules, inserted actually within the lens, to duplicate many of the effects you can get using some of the elaborate 'system filter' outfits which are now available. These include soft focus and diffusion effects, graduated colour variations, streamers and colour ring filters.

If you have a selection of camera special effects filters, try placing each one of these in front of your enlarger lens next time you are in an experimental frame of mind. Prism effects can be particularly effective. You may find it better to use the camera filter holder beneath the lens to hold filters such as this. Others, such as graduated colour filters, will probably work just as well if placed in the enlarger filter drawer. If the camera filter holder will not adjust to the diameter of your enlarging lens, try using folded card stoppers to make up the difference.

Any interruption of the light path in this way reduces the sharpness of the image, though this is acceptable with all but very big enlargements.

Other interesting effects can be obtained by using patterned foils laid on the print during exposure. Some of these can result in fascinating 'moiré' (blurred) patterns if combined so that each of the images in the print overlaps slightly.

Robinson/Brown

Assignment

Autumn tints

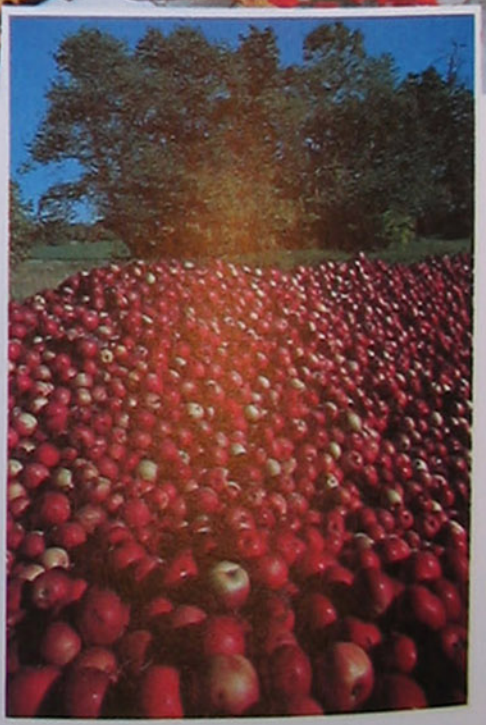
The Canadian autumn is famous throughout the world for its intensity of colour so we asked local photographer John de Visser to capture some of its beauty on film

John de Visser

At first photographing the colours of autumn may appear to be a straightforward photographic exercise—one bound to produce impressive results—but this is deceptive. The leaves and trees often look beautiful to the eye since eyes have the capacity to scan a scene, picking out the most attractive areas.

However, when you hold a camera up to a screen for a photograph, you may often find that there is not really enough in the frame to produce a very interesting picture. Maybe there are too many bare trees, or it may be that the lens just picks out a random bunch of leaves, none of which are particularly attractive by themselves.

Photographer John de Visser lives in Canada and therefore has become accustomed to making the best of some of the most colourful scenery in the world. Every autumn, or 'fall' as it is known in North America, the change of season is signified by an explosion of colour around the wooded areas of the provinces. To make the most of the spectacular show that the countryside puts on, John has developed several techniques to ensure that the beauty is not lost in the attempt to capture it within the confines of a slide.



Birch trees *Rather than include the entire trees, John has concentrated on a close view to reveal more of the textured bark and the coloured leaves. By working at the maximum aperture of the 35 mm lens, the background has been thrown out of focus.* **Apples** *A 21 mm lens allowed the fruit to dominate the frame. To obtain the necessary depth of field, John stopped down to f/16*

One of the most obvious ways of making the picture work well is to use the best light for the subject—John took all of these shots either early in the morning or last thing in the afternoon. He finds that the warmth of the light and its modelling effects enhance the appearance of the leaves. Another method he used to get the most out of the subject was to focus selectively to render one leaf or group of leaves sharp while the surrounding area of colour is left blurred. He also likes to combine the colour with something else—perhaps by including a building which typifies a pastoral scene or by making colours form part of a larger pattern. For subjects like this it is important to check the depth of field before taking a shot. John always uses his depth of field preview

Birch woods *Soft, low light striking the tops of these silvery trees has brought out the subtle hint of colour in this almost monochrome scene.* **Looking up** *The 21 mm lens produced a pattern out of some overhanging leaves.* **Shafts of light** *Shooting into the sun created a silhouette effect. The shafts of light were accentuated by mist*

John de Visser

button to ensure that the whole subject is in focus or that unwanted background details are rendered a blur by using a wide aperture.

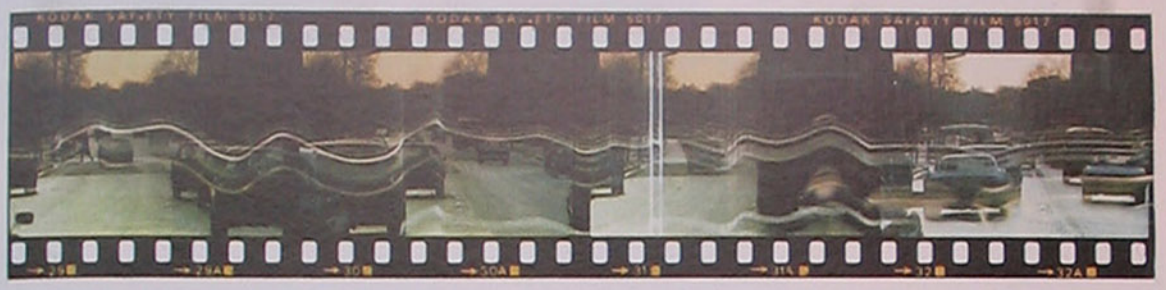
Simplification is one of the key rules that John tries to follow when photographing natural subjects like leaves or autumn colours in general. He feels it is important to scan the whole frame, eliminating any unnecessary details. This often means moving in close to concentrate on the main details selected so that there are no distractions around the edges of the frame. Using a Leicaflex, John shot all the photographs on Kodachrome film to make the most of the colours.

Maple leaves *Simplicity is the key to John's treatment of leaves* **White house** *He looked for subjects to combine with the autumn colours.* **Cows** *While out walking early, John came across these cows at their feed. A 135 mm lens to isolated them from their surroundings*

What went wrong?

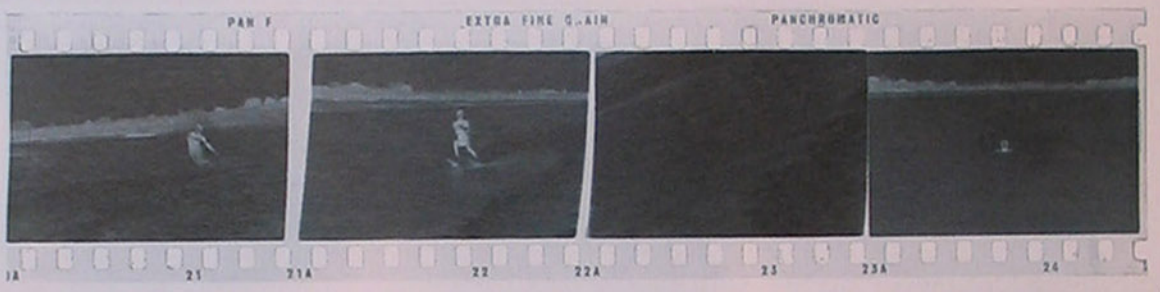
Shutter problems

Most shutters have interlocking safety mechanisms to ensure smooth running—but wear and tear can lead to some expensive problems



The cause of these streaks, which had ruined this film as well as others before, was traced to a focal plane shutter blind which failed to close completely. On rewinding, streaks become slits at pauses

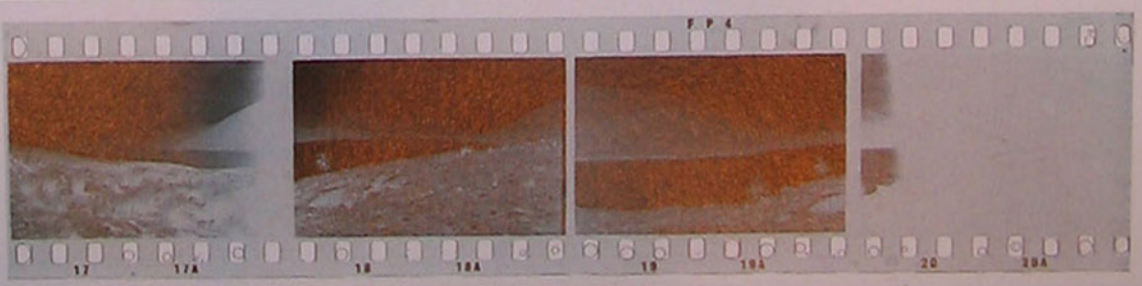
This intriguing distortion of the frame resulted from a fault in the synchronization of motorized film wind and shutter blind travel—perhaps caused by attempting to alter the shutter speed during the sequence



The vertical pictures display a strange fogging mark along what is effectively the lower edge of the film. As proved by the black and white picture taken shortly afterwards, the fault does not occur when the camera was used horizontally. This points to mirror bounce—when the mirror bounces back and obstructs part of the picture

These streaks were the result of using time exposures in conjunction with the wrong motorized wind-on programme on a sophisticated motordrive camera

Three of the frames here show a fault with the blinds of a focal plane shutter. The second blind has speeded up, causing premature capping in the first and last frames, and has rebounded in the second frame



Mother and child

Whether you are taking formal portraits or candid shots, the theme of mother and child offers lots of scope for material ranging from the moment of birth right through childhood

Liba Taylor/Action Aid

Kenyan mother and child *Hands and arms can be used to introduce a strong line into a simple composition, and to join two subjects more closely together*

One of the great traditional themes in painting and sculpture—the portrait of mother and child—can also be a very rewarding subject for photography.

A natural time to start is when the mother is expecting. Maternity clothes are seldom flattering, however, and you can express more about the condition of pregnancy if you have the chance to photograph the mother-to-be nude. Clearly this will be easier if you are the father of the child or a close friend of the expectant mother. A woman photographer may find she has far more natural sympathy and understanding for the pregnant state. Equally, the pregnant woman may feel at ease with another woman, and so may express her feelings more clearly.

A gentle window light, especially on an overcast day when there are no shadows, is best for emphasizing the newly rounded form of the mother-to-be. Try to take this type of picture against a plain background, since you are dealing mainly with light and form, and a cluttered background will be a distraction.

If your subject is reluctant to pose in the nude, ask her to dress in something very lightweight, and look at the silhouette effect that is produced when you backlight such clothing so that the pregnant form is contrasted with the surrounding garment. While the shape is the most important part of the photograph, do not ignore details of the body. Her hands, for instance, can be used to emphasize the increased girth, and her face, in particular, at this highly emotional time, may betray feelings of joy, on the one hand, and tiredness and discomfort, on the other.

If there are other children in the family, you can use their excitement and interest at the prospect of a new brother or sister to great effect in the picture. Again, try to use simple window light, with an additional reflector if necessary. Seat the mother in a chair, with the child at her feet feeling for the baby's movements with face or hands pressed up against the pregnant form. Make sure that you can see the child's face clearly in your picture as he or she may very suddenly break into smiles of delight as the baby's kicks are felt. It is probably best to stand back, using a telephoto lens, and frame closely.

The shape of the expectant mother changes predictably over a period of time, and you may find it interesting, particularly if you are the father, to make a monthly photographic record of these developments, concentrating on simple shape and form and framing quite closely to avoid distractions.

As the time of confinement approaches, you may consider taking some photographs of the birth itself. While a home delivery gives you a marvellous opportunity to photograph the event in the peace and quiet of a bedroom, some hospitals allow photography during a normal labour and birth, particularly if you are the father. Always ask permission first, and see if the hospital authorities will let you look at the labour ward beforehand, so that you can assess what equipment and film it would be best to use.

In the circumstances of a birth it is probably kinder not to use flash, and many hospitals would prefer that you do not, in any case. A fast black and white film will be best for this occasion, and a wide angle lens may be useful to show the mother in the context of the busy hospital labour ward, and may be essential in the more cramped delivery room if you want to show the whole scene in one shot.

Ideally, to avoid changing lenses and missing a few precious seconds, it is best to have a second camera with you, even if you have to borrow it for the day, so that you can also take some telephoto shots of the mother's face as it

reveals the extremes of physical pain and intense joy as the baby arrives. At this point you will have to stand back in order not to be in the way of the delivery itself, so it may be an idea to find something to stand on, so that you still have a clear view of the birth. Always discuss with the mother the type of photographs you want to take well before labour actually begins. There may well be certain moments that she does not want to be recorded on film.

When the baby has arrived safely and is handed to the mother to hold for the first time, the nature of your subject changes dramatically. Make sure that you are ready, not only for the ecstatic moment when mother first sees the child she has been carrying for so long, but also for the time when you are no longer dealing with one person as the principal subject of the photograph, but two, each of whom is as important as the other. This may not seem so obvious at first, since most babies are red-faced, wrinkled little beings, who do not seem attractive to any but their own parents. It is up to you, as the photographer, to try to make the best portrait possible at this time, for it may be this first mother and child photograph that will be the most cherished recollection the proud parents possess of their child.

At this early stage a black and white portrait may be best if the baby is particularly red-faced, and a medium telephoto lens may be a useful way of capturing these first precious moments without being intrusive. Photographing two people together is considerably more challenging than photographing one person alone, and both composition and lighting will now need more consideration. Do not expect any expression on a newly-born baby's face, except those extremes of hunger, discomfort or sleepiness, but concentrate instead on the mother's expressions as she reacts to the demands of her new infant with love and attention. There will be plenty of time to reveal the baby's expression after a few weeks.

Watch the mother as she inspects each part of the new baby, and you may catch that delightful moment as she counts both fingers and toes, just to make sure that everything is there. Do not try to pose your subjects, or readjust their clothes or hair for this first portrait, but see instead how you can get a better viewpoint by altering your position, perhaps

Tee-shirts *If strong directional light falls on your subjects, use fill-in light or a reflector to show the subjects' faces more clearly*

Richard & Sally Greenhill

Peek-a-boo *Seating a child on the mother's lap gives you the chance of a clear profile shot, and allows your subjects to interact more closely*

Chusak/Susan Griggs Agency

Hands *You do not have to show faces in all your shots—details can be just as effective, especially where the lighting brings out colour and texture*

Thai mother and child *Good images arise naturally from the harmonious form of mother and child so be prepared for candids*

using a chair to stand on to look down. In particular, do not disturb the moment when the baby first feeds. Your photographs at this stage can exploit the difference in size between mother and child. Sometimes details can express this best, for instance, a close-up of a tiny fist curled around an adult finger, or a tiny head suckling a breast which may almost equal its size.

The first formal photographs of mother and child are usually taken after four or five weeks have passed. There is good reason for this since, by this time, most babies are, quite simply, a lot better looking, and most mothers are too. Both have had a chance to recover from the ordeal of birth and settle into a daily routine; more importantly mother and child have had the chance to get to know one another and established a relationship upon which you can concentrate.

One factor which will help enormously at this stage is that the baby's eyes begin to focus and look around. The mother undoubtedly will be delighted at this development which is a prelude to other facial expressions and this first important contact between mother and child is not difficult to show in your pictures. If you place mother and baby in a chair in front of a window so that the mother is holding the baby in front of her, and both faces are seen in profile for instance, the baby may gaze up into the mother's face

and you will be able to show how one responds to the other quite clearly.

This kind of shot benefits from a broad diffused light source from the window. Use just a white card reflector to fill in shadows because a complex lighting set-up may destroy the mood of quiet informality which exists, while flash shots may fluster the baby. In addition, the bright light generated by flash can often reflect surrounding colours on to the baby's very pale skin. For the same reason it is probably best to avoid bright backgrounds and pay careful attention to what the mother may be wearing which may have the same effect.

Homer Sykes

John Garrett

Counting toes *For the first portrait in hospital, stand back and use a telephoto lens, and you may catch an intimate moment without intruding*

Looming shadow *Shadows can play an important part in a composition. Here the shadow of a building seems to both menace and protect the couple*

On the grass *When taking candid shots, set a fast shutter to stop the action. This picture makes creative use of a dynamic shadow as a foreground, while a high angle gives an uncluttered view of the scene*

This type of composition with mother and baby in profile at a window with one face close to and responding to another usually works very well. In mother and child portraits in particular, where a successful composition depends on the happy relationship of one face to another, the position of the two heads within the frame is crucial. Neither head should dominate the picture entirely.

Generally, it is best to arrange the subjects so that the two heads fall on a diagonal, perhaps one slightly above and to the left, the other slightly below and to the right. A degree of overlap, where one head is in front of the other, creates an interesting balance of shapes within the frame as well. Occasionally pictures in which two faces are side by side can work well, but usually this arrangement needs some extra element, perhaps the subjects' arms or hands, to balance the design.

Bathtime is always a good moment for capturing mother and child together, and a transparent plastic bath avoids the need for a high angle position to include more baby and less bath. In this case, try to keep the background fairly plain and clear of the usual bathroom clutter which will only detract from your shot. Drape the offending background with bath-towels, if necessary, make sure that you can see the mother's and baby's expression clearly, and be prepared for a certain amount of movement.

The first birthday usually brings the age of mobility, and the problems for the photographer now change. Toddlers are likely to remove themselves from the picture at short notice to investigate a new toy. The best way to create a few relatively still moments for both mother and child is to encourage a game together. As the child grows up you will find this an increasingly useful way of keeping your subjects in one place and producing interesting situations.

Always be prepared to take plenty of photographs where children are concerned, partly to make sure that you catch all the unpredictable expressions and movements, and partly to get them used to the camera. The more they see it the more they are likely to return to the activities you want to photograph. If you do direct your subjects, it is important with mother and child portraits not to destroy any natural expressions, so watch carefully the way in which they behave together naturally, rather than imposing anything on them.

Mealtimes, outings and bedtime are good occasions. Always try to give a shot a little extra thought to lift the picture out the ordinary. For instance, a mother and child reading together could be viewed through a half-opened door, or from outside a window, so that the door or window provides a frame within the picture to enclose the pair and enhance the intimacy of the occasion. The window as a frame can also be used in reverse with a playful encounter in the garden photographed from inside.

John Garrett/Tony Stone Associates

Pregnant mother *Soft focus works well with delicate subject material, while delicate backlighting and a pale, clear background help to soften the image*

John Garrett

Heads together *Faces side by side make a more interesting composition when they are at slightly different angles. Hands can be used to balance the shot*

Professional flash

The considerable power of advanced flashguns allow you to use flash in a wide variety of photographic situations, and shoot without problems under virtually any kind of lighting conditions

Hammerhead *A typical powerful flashgun, mounted on its sturdy adjustable bracket. The powerful main head swivels up (below), allowing the photographer to bounce light on to the subject, while the fixed secondary head, located beneath it, provides fill-in light to prevent unpleasant shadows under the chin and nose*

Dave King/equipment courtesy of Nikon & Monitor

For shots of the family at home, the illumination provided by a small amateur flashgun is usually adequate. But if you wish to do anything more ambitious, you may have to buy one of the guns designed for the professional. Professional units are much more powerful and versatile—they recycle more quickly and deliver more flashes per set or charge of batteries. They can also cover wider angles, and are adjustable over a greater output range.

The extra power of a professional unit is particularly valuable. While an amateur unit may have a guide number of 20 with 100 ASA film, the GN for a professional unit may be 70 or more. This is the difference between having to use an aperture of *f*/4 at 5 m and being able to use it at 15 m or more.

Power is especially useful in automatic flash photography—the photographer is left free to concentrate on the subject, knowing that most situations are well within the range of the flashgun. Also, for bounced flash, which requires an increase in exposure of two to four stops, power is essential. The greater the power of the unit, the more chance there is of using a small enough aperture to obtain good depth of field even with the most difficult subject.

Types of unit

Most small amateur units are light enough to clamp on the 'hot shoe' of the camera without placing strain on the camera body. Professional units, however, are considerably heavier, and the flat lighting given by the centrally mounted flash is rarely that desired by professional photographers. For these reasons, professional units are generally mounted on a bracket bolted to the camera, which positions the flash head above and to one side, giving some modelling to the subject and avoiding 'red eye' effect.

Brackets come in different shapes and sizes, but usually incorporate a grip. The *hammerhead* type of gun, sometimes known as the 'potato masher' because of its shape, incorporates a tube which contains the batteries and acts as a grip. With the more powerful units, the battery pack is contained in a separate unit, suspended from the photographer's shoulder and connected to the flash head by a cable.

As well as the true professional units, some small but very powerful amateur units are available. These are light enough to be fitted to the hot shoe, but can be mounted on a bracket if desired. The Olympus T32, for example, clamps on to the hot shoe of the camera, but, with

the addition of a combined grip and battery housing, it converts into a hammerhead type. With a guide number of 32 (see page 228), it provides more power for amateur units.

Automatic flash

Most modern professional flashguns are automatic and have a sensor which measures the light reflected from the subject, cutting off the flash when exposure is correct for the stop being used. Most are also thyristorized, which means that after each flash, unused power is stored in the capacitors and used for the next flash.

The flash duration of powerful automatic units varies greatly. At full power, it may be as long as 1/200 second. With this duration, rapid movement might be blurred, so bear this in mind when shooting moving subjects at medium distances. When working on automatic, however, flash duration is unlikely to be longer than 1/1000 second, so you should not have any problems with moving subjects. At close range, the duration is much shorter, and may be as little as 1/25,000 second, freezing the fastest action.

Power pack *Although this unit has a grip, its batteries are very bulky and must be housed in a separate power pack. Many of the more powerful guns use this system, which is convenient and manoeuvrable.*

Wide angle diffusers *are used to increase the angle of coverage of flashguns. Some are incorporated in the unit and swivel over the reflector (left), while others are separate and can be clipped into place when required (right)*

Professional units recycle much faster than amateur guns—even at full power, recycling time should not be more than three or four seconds. This can be invaluable in situations where you wish to take many shots in quick succession. On automatic operation, recycling time is much shorter, and when shooting close can be as little as ½ second.

With nearly all professional units, you can choose between a much wider number of apertures for every film speed. With most cheaper units, the range is rarely more than two stops but with the professional guns, there is a choice of four or more stops. As you set the film speed on the gun, a counter moves to show the different apertures that you can use with that film speed. You then simply set the desired aperture on both the flashgun and the lens: the flashgun automatically adjusts the intensity of the flash to suit the aperture which has been set.

There are two advantages to this wide range of aperture settings. First, it allows you to choose the aperture to obtain exactly the depth of field you want, though with a fast film you may still not be able to open up the lens quite far enough to blur the background completely.

Second, it means that you can set a wide aperture so that the flash functions at low power. When the gun uses less power, it recycles faster so you can set a wide aperture when you want rapid recycling time. This can be particularly valuable when you use flash with a motor drive. Some units also have a facility for working at half power in the manual mode, which also saves batteries—however, automatic operation is the most economic way of working over all.

Bounced flash

Since a great deal of flash photography is done with bounced flash, it is important that an automatic gun should be able to read the light off the subject, even though the head is tilted in another direction. The most useful type of gun is that which allows you to tilt the reflector in as many directions as possible while the sensor remains pointing at the subject, such as for example the Metz Mecablitz 60 CT1.

A remote sensor, separate from the flash head, is especially useful when you are using a hammerhead unit, because it is near the lens and reads roughly the same area of the subject. The Braun remote sensor is very versatile, allowing 22 different aperture settings at a third of a stop intervals.

Michael Freeman

Beetle *For close-up shots where detail is important, a conventional flashgun is unsuitable because it casts heavy shadows at close range, hiding detail; ring flash cancels out these shadows by casting light from all sides at once*

Dave King

Remote sensor *When the flash head is used at a distance from the camera, it is important to have an exposure reading from the camera position. This sensor has a facility for 22 different aperture settings at intervals of one third of a stop*

Most advanced flashguns will illuminate the subject over an angle of about 50°, but the coverage can be increased for wide angle lens shots in one of two ways. With units such as the Braun, there is a special built-in diffuser that can be pulled down over the reflector to spread the light out more. Others have a flash tube that is reversed to give extra coverage when the gun is set on 'wide angle'. Both these methods increase the angle of illumination to 65–75°, enough for a 28 mm or even 24 mm lens on a 35 mm camera.

Another common feature on professional flashguns is the facility to swivel the head for bounced flash shots (see page 345). The more positions the head allows you, the better. If, for example, you are bouncing the flash off the ceiling, the head is tilted upwards. But if, with the head in this position, you turn your camera to shoot in the vertical format, the flash will bounce off the wall. With a fully tilting reflector, you can keep the flash unit pointing at the ceiling.

Some of the recent hammerhead units incorporate a secondary flash head below the main one and this could be a valuable feature if you anticipate using bounced flash frequently. Without the secondary flash, light bounced from the ceiling falls on the subject from above, and may cause sharp shadows under the eyes, nose and chin. The secondary flash head points directly at the subject and fills in these shadows giving much more acceptable results for lighting most types of portraits.

It is also an advantage to have a flash unit which can easily be detached from its bracket, so that you can hold it away from the camera. When using bounced flash, the more freedom you have in adjusting the angle and position of the flash head, the more control you have over the amount and quality of the light.

Extension heads

Many advanced units allow extra flash heads to be connected to the power pack by cables. This greatly increases the control you have over lighting and modelling. The extra heads are powered by the capacitors either in the main gun or in the extra head.

With the capacitor in the main gun, there is no extra power to fire the extension heads so power from the main gun is split between all the heads. If you are using three heads, for example, each will give out one third as much power as the main head would on its own. Using a capacitor in the extra head, each head operates at the same power so you exhaust the batteries sooner, but have more light at your disposal and this can often be a great advantage.

Since both arrangements make use of cables to connect the units, triggering is more reliable than when using slave units. There is a limit to the distance at which you can place the heads, but for most purposes this should not be a problem.

Peter Dazeley

Dave King/equipment by courtesy of Nikon

Ring flash *This type of gun is useful in portraiture where gentle lighting is desired.* **Hair** *can be given a 'soft' look, while other details of the face remain distinct. This effect is most pronounced at fairly close range*

Ring flash

Even when a flash unit is used in the hot shoe of the camera, it produces small but sharp shadows on the subject. The closer the subject is, the more noticeable these shadows become, until at macro distances they become excessive and mask parts of the subject.

If you do a great deal of macro photography, you might consider using one of the ring flash units designed for close-up work. These fit around the lens, usually screwing into the filter thread. When you shoot a close-up subject with one of these units, the light falls from all sides, cancelling out all shadows. Shooting from further back, though, casts shadows.

These units are powered by a separate pack, connected to the tube by a cable. They are normally used for medical photography or technical work, but they can also be used for fashion photography when shadow-free results are desired. However, they do not usually have sufficient power for studio work except at close range. For macro work, their power is ample. Some units, such as the Olympus ring flash, have the added advantage of TTL metering automation which measures the field covered by the lens for accurate exposure in close-ups.

Power sources

Several different types of power source are available for professional flashguns, each with its pros and cons. Lead-acid accumulators need constant attention and must be kept permanently charged, but have a greater capacity and recycle faster than nickel-cadmium cells, which are also more expensive. Nickel-cadmium cells, however, are sealed and need no maintenance other than charging.

Zinc-carbon batteries are inexpensive but cannot be recharged, so if you plan to take many flash pictures they are not practical. Manganese alkaline cells, though they have a longer life, are more costly. The new Barix Dry Cells combine the capacity of the lead-acid accumulator with the convenience of the nickel-cadmium type, and cannot be over-charged, as some other cells can.

Some flash units can be powered by a High Voltage Dry Battery Pack, such as the Vivitar, which supplies 510 volts. These cells recycle the unit rapidly, and deliver many flashes before being exhausted, but they are costly and heavy. Most cannot be recharged either, although for some units, such as the Sunpak range, there is a rechargeable nickel-cadmium 510 volt pack.

Professional units can also be powered by the mains, but this is only practical if you are not moving about very much—indoor flash photography is the obvious choice for this source. Your choice of power source must depend on the type of photography you intend to do, as well as the amount you want to spend.

Choosing a unit

The professional gun you choose depends on the amount of flash work you plan to do. To a certain extent, your choice is determined by the 'feel' of the unit—you may find a particular grip more comfortable than another. Look at the bracket, also—it should be as rugged as possible, and made in such a way as to prevent the camera from twisting. You should be able to hold it comfortably and steadily at all times.

If power is your primary concern—and this is the greatest advantage of professional flash—then buy the unit which gives you ample reserves of power, the most powerful you can afford. Bear in mind, also, that if you are to do much bounce flash work, a head which can tilt in any direction is a great advantage for control over modelling.

Dave King

A reflector *is an asset when working with bounce flash*

Direct flash *gives sharp, unpleasant shadows to faces*

Bounce flash *gives diffused light from one side only*

Combining *bounce and direct light gives best results*

Understanding...

Zoom lenses

One of the photographer's greatest aids to composition is being able to choose a suitable focal length. Zoom and varifocus lenses give an infinite variety of focal lengths over a certain range with a single lens

Ray Duns

Changing size *The advantage of a zoom lies in being able to choose the best focal length without the trouble of changing lenses*

Composing photographs is undoubtedly made much easier if you can choose the focal length of the lens to give exactly the framing you require. Unfortunately, with fixed focal length lenses, this means not only time wasting and inconvenient lens changing, but also that you may not be able to get precisely the framing you want because it falls between two focal length steps. The zoom lens solves both these problems for still photographers, and, for movie makers, it has the added advantage of allowing the cameraman to change the focal length while shooting.

The basic principle behind zoom lenses is quite simple, relying essentially on two moving elements to vary the focal length. But in practice they are actually fairly complex and include a large number of extra correction elements. Zoom lenses should not be confused with the far simpler *varifocal* design which also gives the facility for changing focal length but will not hold the subject in focus as the focal length is changed.

The range of focal lengths of a zoom lens is given by the *zoom ratio*. This is the ratio of the longest to the shortest focal lengths, so that an 80–200 mm zoom lens has a zoom ratio of 2.5:1. For 35 mm still photography zoom ratios of 2:1 to 6:1 are common. For movie photography and video cameras, zoom ratios of 10:1 to 20:1 or even more are used. This is because the small formats of movie and video cameras use only the sharp centre of the image produced by the lens so less correction is needed, allowing more ambitious designs.

A basic variable focal length lens can be made from just two elements. Each element has its own focal length, with either negative or positive properties (see page 1266). The focal length of the two combined, often called the *equivalent focal length*, is given by a complex formula involving not only the individual focal lengths of the elements but also the distances between them along the optical axis—the *separations*.

If an element is moved along the optical axis, the separation changes, and so does the equivalent focal length. The simplest arrangement would be a positive front element and a negative rear element. As they are moved nearer to each other focal length increases because the rear element progressively spreads the light coming from the front element. This means that the image is formed further away from the lens.

Unfortunately, such a lens would suffer from two major defects: the lens would have to be refocused after every movement—that is, it would be varifocal—and it would suffer severely from aberrations. To correct these faults, a large number of extra elements are needed, and zoom lenses may have between 8 and 20.

Focus compensation

Extra elements are used, moving in conjunction with the zoom element, to keep the image in focus. This form of correction is called *compensation* and there are two types—*optical* and *mechanical*—commonly used in modern zoom lenses.

Optical compensation means the zoom and correction elements are coupled together so that they move the same distance. The correction is achieved by careful choice of the correcting element or group, in terms of glass and lens types, so that it interacts with the other elements in the right way at every setting.

With mechanical compensation, the zoom and correction elements are separate, moving at different rates and sometimes in different direc-

tions, so compensation is achieved by variation of the lens separations.

Optical compensation was originally preferred, as the lens unit and internal mechanisms were easier to manufacture. But now that complex control cams can be cut using computer controlled lathes, mechanical compensation is more popular since it allows higher levels of correction. If you look into the front of a modern zoom while turning the zoom ring, you can often see the lens groups moving. Quite often the groups follow non-linear paths—that is, as the zoom control is turned through its range the elements advance, then recede, then advance again. Even some optically corrected zooms also use some degree of mechanical compensation in order to obtain the best possible results.

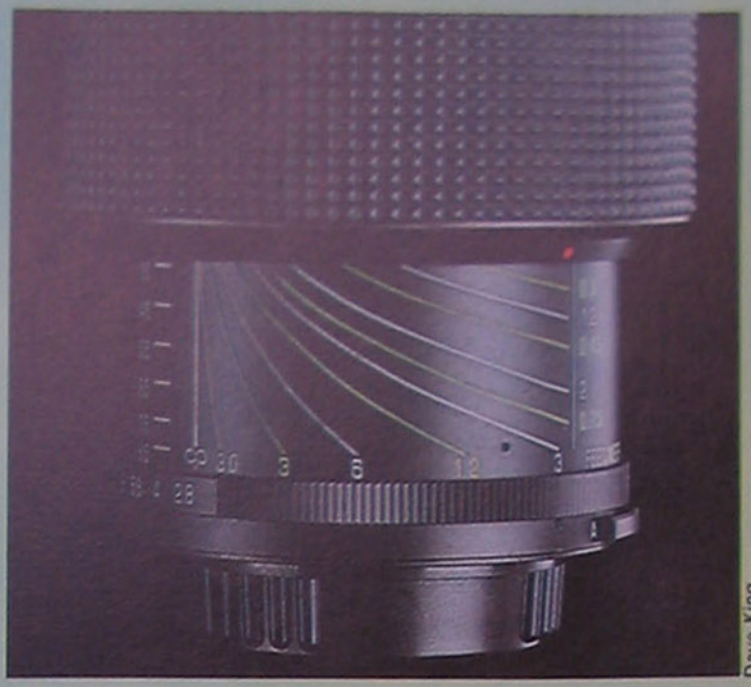
The classic zoom lens design has four groups of elements. The zoom and correcting groups are located between a front group which moves to focus the image, and a fixed rear group which contains the iris diaphragm. This rear group is positive and focuses the image formed by the other groups on to the film.

The fact that the rear group is fixed also helps to keep the aperture constant as the focal length is changed. This is because the effective *f*-number depends on the *exit pupil*. This is the image of the iris diaphragm as seen through the rear of the lens, and its size depends on the size of the aperture and the optical design of the lens. As the rear group remains fixed the exit pupil also remains fixed for each aperture setting, no matter which focal length setting is used.

One drawback with this type of design is that the closest focusing distance is far from the lens. Sometimes the closest distance is one or even two metres. This has been overcome to some extent in recent designs which move all the elements when focusing. Unfortunately, this means that the *f*-number also changes when the lens is zoomed giving a loss of a half to one stop from minimum to maximum setting.

This problem can be avoided by using a separate focusing mechanism for close distances, and many zoom lenses have a 'macro-zoom' control. With the focal length set at a particular point (usually at one end of the scale) operating a switch allows the zoom ring to be used as a focus control. Focusing is achieved by moving one or more of the groups to give a form of *internal focusing* over a limited close-up range.

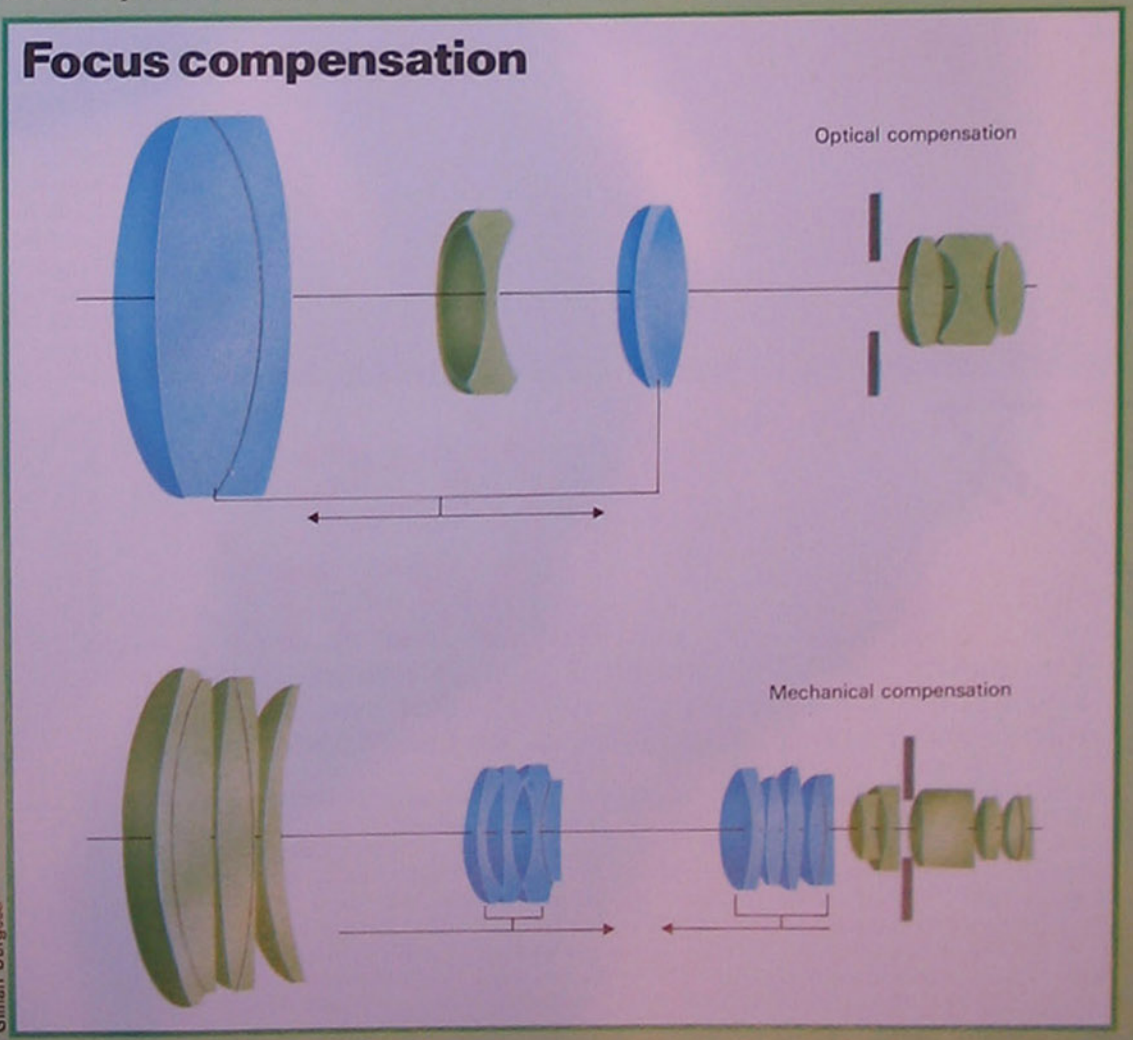
The performance with this type of system is often mediocre with the image suffering badly from field curvature and barrel distortion (see page 906). In fact distortion is a common problem with zoom lenses because of the asymmetrical layout which they use. The longer focal length setting tends to give pincushion distortion, and some lenses give barrel distortion at the shorter setting. However, modern computer designs and improved optical glasses mean that performance is usually good enough and may approach that of a fixed focal length lens. The main exceptions are wide-to-telephoto zooms, such as a 35-70 mm, which may give one type of distortion as a wide angle and another as a telephoto.



Dave King

Variable focus *In order to simplify the design this lens is a varifocal and the distance scale marked on the lens barrel changes with the focal length*

Focus compensation



Gillian Burgess

Moving elements *To keep the image in focus as the focal length is changed, zoom lenses use compensating elements or groups linked to the zoom elements. In the case of optical compensation the two elements are linked together, but with mechanical compensation they move independently*

Leo Mason

For this assignment we asked Leo to see how much he could cover on his own so he began the day by carefully studying the programme to work out how to allot his time most productively. As he explained, 'Sometimes I find that I can shoot the pole vault and, during the pauses between competitions, use a long lens to shoot across to a track event—say a group of runners. At other times it is not so easy and you have to be fairly athletic yourself to rush around and get the pictures you want.'

Leo felt that the best approach was to pick out just a few events to photograph and to concentrate on producing some good shots from these. Often, the viewpoint depends very much on where the photographer is allowed to stand. However, regardless of whether or not the photographer is covering a large or small event, or is working from privileged positions or not, there are certain shots which work best for each event. With track events, for example, you usually have to go for what Leo calls the 'classic shots'—shooting straight down the track with a long telephoto, or catching the runners as they pass a bend. Unless you can find an elevated viewpoint, the finishing line is difficult to cover well as access for photographers is usually restricted because of the photofinish cameras.

Leo finds that a fair amount of equipment is needed—he uses a range of lenses from 16 to 800 mm for a major event. For these shots Leo made plenty of use of his 300 mm lens—either alone or with a TC-14 teleconverter which gives a focal length of 420 mm. Always fearing the worst from the weather, Leo takes along plenty of Ektachrome 200 and 400 as well as his standard films, Ektachrome and Kodachrome 64. But he pointed out that athletics really needs bright sunny weather—'If the day is dull and cold, the athletes will look dull and cold, and the pictures won't have the punch you get from working in bright, clear light.'

Assignment

Athletics event

You cannot cover all the events at an athletics meet and expect perfect results overall. But you can find many varied and exciting images, as Leo Mason shows

An athletics event offers the opportunity to photograph a wide range of sports in a single day—all exciting, dynamic and highly suited to photography. However, the intensive programme which is usually a feature of such events creates problems—track and field events are held concurrently so the photographer has to make decisions about which activities to cover.

As a professional sports photographer, Leo Mason is used to dealing with situations like this. When shooting for his own picture stock Leo would not attempt to cover everything in a single day—instead he might spend hours just concentrating on getting one dynamic shot of the high jump, or some other event which he finds makes particularly good strong images.

Pole vault *Using a Nikon FE fitted with an 18 mm lens, Leo achieved a silhouette effect by operating the camera on its automatic mode so that the reading was taken from the sky.* **Start** *From the back of the stadium, Leo used a 300 mm lens to frame his shot exploiting the graphic lines and the diagonal row of runners. Using a shutter speed of 1/250 second he stopped down to f/8 for the depth of field he needed.* **Candids** *The exhausted runners and the starting official illustrate the sort of static shot that can also be taken at these events during the pauses between competitions*

Water jump *By shooting the first jump of the steeplechase, Leo caught all the runners while they were still bunched together. Fitting the 300 mm lens and TC-14 teleconverter he used the 'classic' head-on viewing position. An aperture of f/8 gave him enough depth of field to keep all the leaders in focus while a shutter speed of 1/500 second froze the movement of the water around their feet.* **High jump** *Using the same lens and converter combination, Leo waited for the moment when the athlete was half way over the bar and the shape of his body looked best.* **Shotput** *This is another 'classic' shot—Leo feels that this is the most worthwhile view. Once again it is a matter of selecting the moment when the shape of the athlete's body looks best (300 mm lens and TC-14 converter).* **Off the blocks** *An 85 mm lens was used to capture the moment when a runner burst away from the starting blocks. Accurate timing is vital for catching moments like this successfully—it is not just a question of firing off the motor drive in the hope that one of the frames will catch the optimum moment. Unlike the other shots which were taken on Ektachrome 200, Leo used Ektachrome 64 for this shot*

Improve your technique

Audio-visual presentations -1

A tape recorded commentary can add an extra dimension to your slide show, particularly if you can record sound effects as you shoot the pictures

George Wright

The sound of steam *Sound effects can easily be recorded on location using just a portable cassette machine*

Even with good pictures, perfect projection and smooth presentation, slide shows can be disappointing, let down by faltering comments and coughs as you struggle to remember where or when the shots were taken, or the name of a particular subject. But if you have a tape recorder, you can make a really professional audio-visual presentation involving anything from a simple prerecorded commentary to a sound track complete with music and sound effects that create the right mood for the slides on the screen.

The most basic audio-visual presentation, with just a sound 'caption' for each slide, can be made using a simple manual projector. But for more sophisticated presentations, an automatic unit is better. And if you want to make a really ambitious show using two projectors to fade one slide almost imperceptibly into the next, automatic projection is essential.

Again, while you can make the simplest slide-tape programme with a basic cassette recorder, it is easier to work with an open reel stereo recorder. Open reel tapes are not only much easier to edit, but many decks also allow you to monitor one track while recording on another, a facility which is very rare on cassette recorders. This makes it much easier to record background sounds and spoken commentary on one channel without affecting the other. This second channel can then be used to synchronize sound and picture, using either spoken instructions (for manual slide change) or electronic pulses to operate a fully automatic projector.

Timing the slide changes

The essence of a carefully planned slide tape show is that each slide change coincides with a specific point on the taped sound track.

The simplest way of timing slide changes is to memorize the show, and just change the slides when you hear the appropriate words in the commentary. However, this can be difficult to do, requiring considerable concentration, and a better technique is to employ an assistant with a script and stopwatch. A simple signal to the projectionist can then indicate when to change the slide.

But it is far better to use one track of the tape to record the slide changing instructions, while the commentary is recorded on the other. Both tracks are played back during the slide shows, but only the main sound track is broadcast to your audience; you can listen to the slide changing track on headphones and change the slide at the appropriate time. The instructions on the slide changing track can be either spoken words or take the form of a loud bleep.

If you have an automatic slide projector, you can go one step further and

Making a soundtrack

Venner Artists

Synchronized sound *With an electronic synchronizer, slides are changed automatically by pulses recorded on a conventional tape cassette*

arrange for the timing track on the tape to change the slides automatically, thereby eliminating the possibility of human error. This can only be done by using a specially designed *slide synchronizer*, which operates the slide change each time a prerecorded cue is reached on one track of the tape.

Two types of synchronizer are available. *External* synchronizers contain their own recording head, and the tape from an open reel recorder has to be physically threaded through this. The *internal* type of synchronizer uses the recording head of the tape recorder itself, and is connected to it only by wires. Of the two types, the internal system is more versatile and easier to use—it can even be used with a cassette tape recorder.

Internal synchronizers work on several systems. Some types require one channel of the tape to be left completely blank and reserved solely for the electronic pulses which actuate the slide change mechanism. Another type requires sound to be recorded on both channels, and the slide change is brought about by the absence of sound over a predetermined period of time on one of the channels. This moment of silence is produced by the operation of the synchronizer in the 'record' mode. The *silent* pause type of synchronizer permits stereo sound (but with brief pauses on one channel as the slide is changing) whereas the *recorded pulse* synchronizer restricts you to mono sound.

Dave King/equipment by courtesy of GAF & Philips

Choosing the slides

For a successful slide show, you generally need to choose a theme that links the slides together. The range of possible themes is immense but there are three basic approaches.

The first is to start with a collection of slides, such as holiday shots, work out a story to link them together and provide a coherent theme.

A second approach is to start from the sounds, and choose slides to suit the sound. You might start with a piece of music or poetry which you find particularly inspiring, and produce a series of images which match those conjured up in your imagination. Disney's *Fantasia* is an example of how this can be done very successfully using movie film.

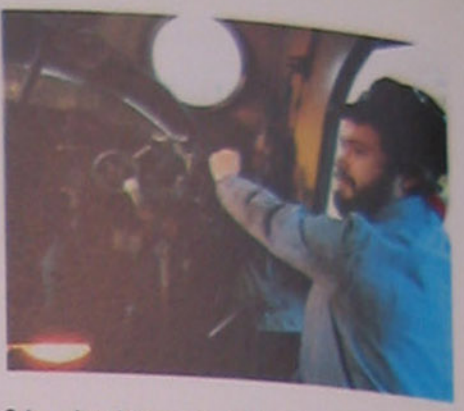
The most challenging way to produce a slide-tape, however, is to start from scratch, and use specially produced sounds and images, woven around a theme that you invent yourself.

However you arrive at a theme, remember that the sounds and images

Sound transfer *If you have a reasonably good home stereo, you should be able to use this to build up a recorded soundtrack by recording from different sources simultaneously*

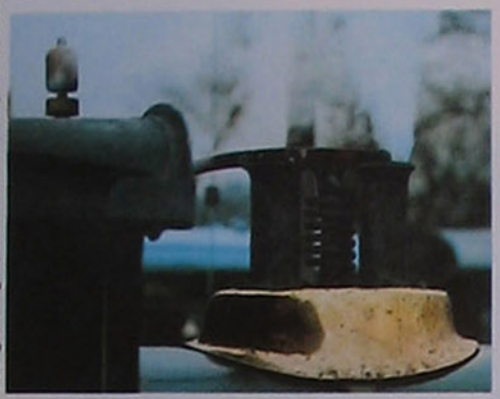
1 *This sequence of pictures shows how you could start an audio-visual sequence about a steam railway. The opening shot needs no verbal commentary, and a tape recording on the spot sets the scene*

2 *The commentary begins, 'The sound of a steam locomotive is only a romantic memory for most people, and today's children are only familiar with diesel trains . . .' On the soundtrack, the puffing of the engine continues*



3 *'. . . but here on a 10 km long stretch of track, a band of enthusiasts keep the sound of steam alive. Putting aside city desks, they take weekend jobs as stokers or drivers'. The soundtrack changes to footplate and stoking noises*

George Wright/location courtesy of The Bluebell Railway



7 *Before this next image, you might choose to insert a second picture of the signal gantry with the arm lowered, perhaps with a clang as it falls. This shot needs no comment, save the shrill sound of the steam whistle blowing*

8 *'With the line ahead clear, the locomotive moves off up the incline, leaving the station in a spectacular cloud of steam and smoke.' On the soundtrack, the gentle hiss of steam gives way to the chuffing of the loco*

9 *As the train accelerates into the distance, the chuffing gets quieter and the rhythm gets faster. This image has been flopped to make the train move in the same direction throughout the sequence, thus preserving continuity*

should complement each other. It should be impossible to remove either the sound or the pictures without adversely affecting the final result.

Once you have chosen a theme, you must select the slides and put them in order. This is most easily done on a lightbox which consists of a backlit sheet of diffusing material on which the slides can be spread out and viewed. Commercially produced light tables are usually simple boxes with a white glass top, and with fluorescent illumination inside, but you can easily make your own. (A subsequent article shows how to make a simple light box). Alternatively, you could use a sheet of glass supported by two chairs and lit from below by a table lamp. A sheet of tissue paper makes an adequate diffuser.

Before making your selection check that none of the slides suffers from technical faults, such as camera shake or innaccurate focusing. When arranging and selecting the slides, there are a number of points to bear in mind.

For example, changing constantly from dark toned slides to light ones breaks the flow of images, and drastic changes of colour have the same effect. Unless the idea of the show is to make deliberate and dramatic contrasts, such disruptive slide changes should be avoided. You should try to avoid changing from vertical pictures to horizontals, as this can interrupt the flow.

Take care also that you do not mix seasons and times. The effect of switching randomly from a picture taken in winter to one taken in the summer is to confuse the audience about the time scale of the show. Try to maintain the natural order of the seasons as far as possible. The same applies to changes in time of day. Slides taken when the sun is low, producing long shadows and warmer colours, look totally different from those taken around noon, with its harsher top lighting.

Just as in movie making it is important to ensure continuity of action as well (see page 1096), and people, animals and vehicles should always move across the screen in the same direction.

Once you have chosen and arranged the slides you can move on to the soundtrack. You may find that you have to remove some of the chosen pictures later, or put some new ones in, to maintain the flow. You might even decide to go out and shoot some linking slides specially for the show—for a trip abroad by plane, for instance, you could go back to the airport for a take-off shot.

Recording a soundtrack

Sound and vision in a slide-tape show depend on each other, and a poor soundtrack can ruin even the best series of slides. If you doubt the importance of sound, try turning down the volume control on your television set, and see how much sense the pictures on the screen make.

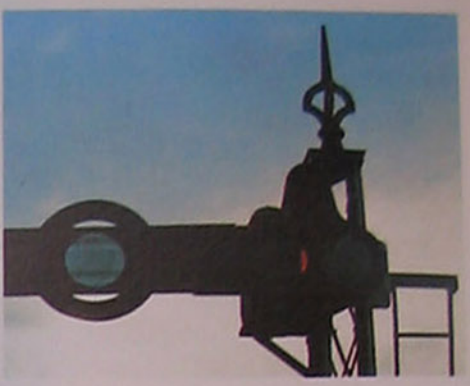
The production of a soundtrack can have as much to do with conjuring up atmosphere as it does with giving information. For example, the sound of seagulls and breaking waves—even before the first slide appears on screen—quickly suggests a seaside scene, and your audience's attention is already half won.

A soundtrack can be as simple or as complex as you want, and at its simplest might consist just of a piece of music, or a spoken commentary. But by combining music, background effects, and speech, you can produce something which sounds a lot more convincing and appropriate.

Most people tend to start with a spoken commentary, and then add the other elements as their confidence increases. Begin by drawing up a script on paper, with a description of the picture on screen in one column and the

4 *These in turn give way to the sound of doors being slammed, and the guard blowing his whistle. The commentary goes on, 'To the weekend visitor, this is just a nostalgic taste of travel as it was in a bygone era . . .'*

5 *Here the slide changes as the commentary continues '. . . but to members of the preservation society who run this tiny line, it is not entirely an amusing joy ride; they view it as a living museum of the steam age.'*



6 *'Despite the fact that the line is so short, and the workforce are all volunteers, the safety requirements of a much larger system must be satisfied. Before leaving the station, the driver must wait for the signal to fall'*

10 *'The tank engine pulling this train was built in 1905, but it is by no means the oldest locomotive on the line. Some were built over a century ago—when all road traffic was horse drawn, and sailing ships were commonplace . . .'*

11 *'. . . As diesel and electric locos replaced them, these majestic fire breathing giants were left to rust, or sold as scrap. Two or three years work are usually needed to restore just one engine to its former glory.'*

12 *This first section of the AV show is brought to a natural conclusion by the train steaming over the horizon. Sound recorded on location is not essential, as many sound effects and background noises are available on record*

accompanying commentary alongside it. If you intend to add sound effects or music later, leave a third column for these, too. Finally, note down slide changing points, and leave a column blank for the elapsed time in seconds.

When writing your script, avoid stating the obvious. If the image on the screen very clearly shows the leaning tower of Pisa, it is unnecessary to tell your audience, 'This is a picture of the leaning tower of Pisa . . . and the next picture shows the nearby cathedral.' Try and tell people something that they cannot see for themselves. A better soundtrack might run: 'The Italian town of Pisa is known all over the world for its spectacular tower . . . but what is less well known is that in this magnificant black and white marble cathedral round the corner, Galileo is said to have discovered the principle of the pendulum. His fascination with the swinging of the cathedral's hanging lamps ultimately led to the invention of the pendulum clock'. Here, a picture of the cathedral from the outside could be followed by an interior shot showing the hanging lanterns.

You may find background music and effects more difficult to put together than the commentary. If you have access to a music library, the staff will probably be able to help you in the choice of appropriate music. You may also find that they keep records of sound effects, which you can record for your production. The libraries may also be able to tell you about the law as it relates to re-recording of gramophone records—in most countries an inexpensive licence is required and if your show is seen in public (rather than your home) a fee may be payable to the musicians who made the record you have taped.

If your soundtrack consists of speech with a background of music and effects, you must turn down the background sound so that the commentary can be heard.

A trial run

When you have recorded your soundtrack, and timed each section of it, you should project the slides on to a small screen to check the rhythmn and pace of the show. At this point you may decide that more pictures are needed in some sections, and fewer in others. As a rough guide, seven or eight changes a minute is a reasonable average, but do not stick religiously to this frequency, or the pace will become monotonous. Three views of the same object might be shown in quick succession, or you may choose to hold one particularly interesting slide on screen for up to fifteen seconds. This is a practical maximum, and if you keep a slide in view for longer, you may find your audience getting bored. The exception is when there is text to read on a slide.

Having matched together the sound and vision, you need to record the timing track. With some tape recorders, this is simply a matter of monitoring the sound track with a pair of headphones, and recording the pulses or verbal instructions on the other track of the tape. More usually, though, you will need to re-record your soundtrack and simultaneously record the timing track. Details of how to do this will vary according to the model of tape deck that you have, and you may need to have special leads made up to link the two machines. It is also a good opportunity to transfer the sound from open reel, on to a cassette, which is more convenient and portable—particularly if you plan to show the slides away from home.

More spectacular slide tape productions are possible using two projectors and a fading device. This advanced technique is covered in the following article in this series.

Combining techniques

The most original and spectacular pictures can be created by experimenting in the darkroom—try mixing various special effects —or try taking each one just another step further . . .

With so many special effects at your disposal, each with its own impressive sounding name, it is easy to become overwhelmed and follow instructions believing that techniques cannot be mixed and that there is only one way to achieve each effect. Yet there is nothing 'correct' about any of the techniques; they are simply ways of achieving certain effects. Indeed most of these special effects, from bas relief to colour posterization, were discovered by experiment, sometimes even by accident, and by experimenting yourself—playing about with the processes, combining various techniques or just taking them further—you can achieve your own original, unique effects.

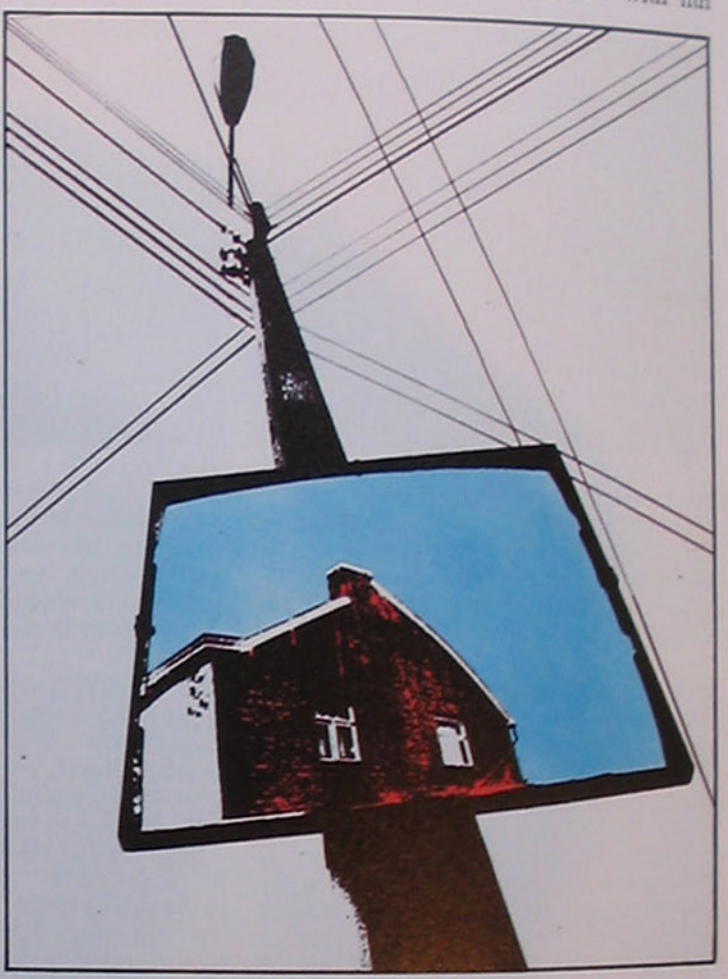
Of course, experiments are, by their very nature, unpredictable and you may have to endure a whole string of disappointing results. And even if you do produce an attractive print, it may not be possible to repeat your success with another photograph because an identical sequence of operations can have a radically different effect on two different photographs. But when you do produce an attractive result, you have the satisfaction of knowing that it is all your own work.

The secret, perhaps, is to assume that nothing in the printing process is sacred, except safety rules. Your experiments can begin at the very simplest level. Instead of printing colour negatives on to negative–positive paper, for instance, why not try printing on paper meant for slides? The colour may be weird, but the results can, with the right negative, look stunning. Alternatively, you could print a slide on to negative–positive paper.

Remember that when experimenting with combinations, you do not necessarily have to waste a full sheet of paper for every negative–slide paper combination that fails. You could, for instance, cut off just a small piece of paper for a trial run. Or try exposing a whole series of negatives in different places on the same sheet before developing, using card to cover and uncover the paper as appropriate, in much the same way as with a test strip—only remembering to cover previously exposed areas for each exposure.

One particularly rewarding line of approach is to make a series of contact prints from slides or negatives on to lith film (see page 914), because with lith

Hubert Grooteclaes



Faces *This unusual graphic image was achieved very simply by combining a high contrast image with hand colouring. The main part of the image—the faces—is a mirror image print of a lith negative. Composition was improved by raising the image right to the top of the frame. To make a picture like this, project your negative on to lith film to make a positive; contact print this to make a negative on lith film, and use this to make the mirror-image print (see page 1474); selectively apply colour toner; and then rephotograph the result on colour film.*
Mirror image *For this picture, all but the central area of a high contrast lith image print was masked off while the print was hand coloured. By using a latex based mask painted on the print, selective toning is possible*

Mike Salter

Guitar player *Unless special care is taken over registration of the various tone separation negatives when printing a colour posterization, a multiple image will result. But even this 'fault' can, with the right subject, be very effective —here a strobe-like effect is created, suggesting a swing movement of the guitar. Another example of how new pictures can be created simply by not taking 'rules' too seriously.*

film you can produce a whole variety of special effects. You can, for instance, print these lith film negatives on to various different types of printing paper. You can print combinations of one lith negative with another in a sandwich or, slightly offset, with the original slide, producing a bas relief effect. You could even print a lith image through various materials such as gelatin. The possibilities are endless.

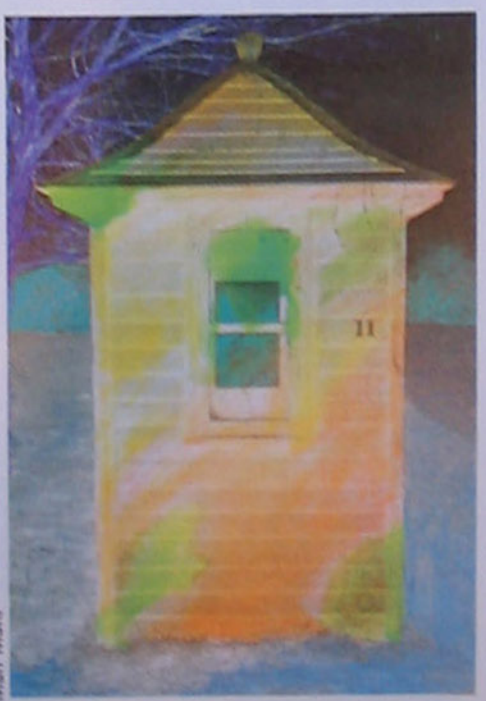
Martin Proctor

Boat house *This picture was produced by combining a same-size copy negative made on line film with the original colour transparency slightly out of register to create a bas-relief effect. This is a simple but often very effective way of creating unusual pictures from your 'spare' transparencies. Simply contact print a batch of original transparencies on to lith film and process this in ordinary developer to get greys instead of pure black. Cut up the individual images, and bind each together with the original. The darker the lith image the more pronounced becomes the bas-relief effect.*

Kiosk *You can use hand colouring techniques for negatives as well as for prints. Black and white negatives treated in this way (below left) can be printed almost as colour negatives to produce colour prints (below). With care, this can give remarkable results— but remember that colour dyes will print as their complementaries*

All these alternatives, known as *derivations* by some darkroom workers, need not stop after one step. In other words, once you have produced a special effect picture, use this derivation as an original and experiment with various special effect techniques to achieve even more unusual results. You could, for instance, take an original negative or the colour negative separation for a posterization effect (see page 925), make a Sabattier effect copy, and then use the copy to make another Sabattier effect copy. With this 'second generation' Sabattier effect copy, you can then make a final print.

Even something as simple as a photogram (see page 818) can be given a new lease of life if used as an integral part of a photogram-photograph combination—and the result can itself be used as the start of a string of derivations. Simply place an object next to the negative or slide in the carrier and project both together, or place an object (on a sheet of glass perhaps) on



Mari Mahr

the print during part or all of the print exposure. Some particularly interesting effects are possible if you are colour printing and are using coloured transparent objects in this way.

If you are experimenting, it is worthwhile getting all the film and solutions together and ready for use before beginning a printing session. To spend a long time preparing different chemicals for each new technique lengthens the

R. Grosskopf/Tony Stone Associates

Tapdance

Temple *An interesting variation to a straightforward posterized image is achieved by printing the image through shaped masks and moving these masks during the sequence of exposures through each colour filter. The masks can be cut from card or made on film, and laid on the print for part or all of each exposure depending on the effect that you are aiming for*

Mick Jagger with Pink Floyd *This improbable combination was achieved by printing several transparency images on a single sheet using plenty of masks. Extensive but subtle retouching conceals image borders but was not used for concealing the tell-tale microphone wire which hangs short. Notice the guitar player on the right originally played more closely with the group*

duration of a particular sequence—and in most forms of derivation work these can be very long anyway.

Obvious shortcuts include continuing printing operations when colour processing with a motorized film processor, for example. If you can process a number of prints at a time, why not try out a few different tests each time? This way, you will not have to wait, say, five minutes to see just one result, which may not be satisfactory in any case. Where you are trying out a number of original images for possible use in solarization experiments, it is much quicker to gauge the effects on a contact print containing all images rather than plod through each one individually by using enlargements—in the process possibly wasting a good deal more material. This is particularly true of second generation work where it is quite possible for a first generation derivation to completely lose its form or colour effect by subsequent manipulations.

It is worth trying as many different approaches as you can. Each one will yield something new. But it is important to note down each step carefully as you go, particularly with second generation derivations because you may wish to repeat a successful sequence—variations can become so complex that it is virtually impossible to repeat successes. And each time you do achieve an attractive result, try taking it one stage further.

Jeff Dunas

Tapdance

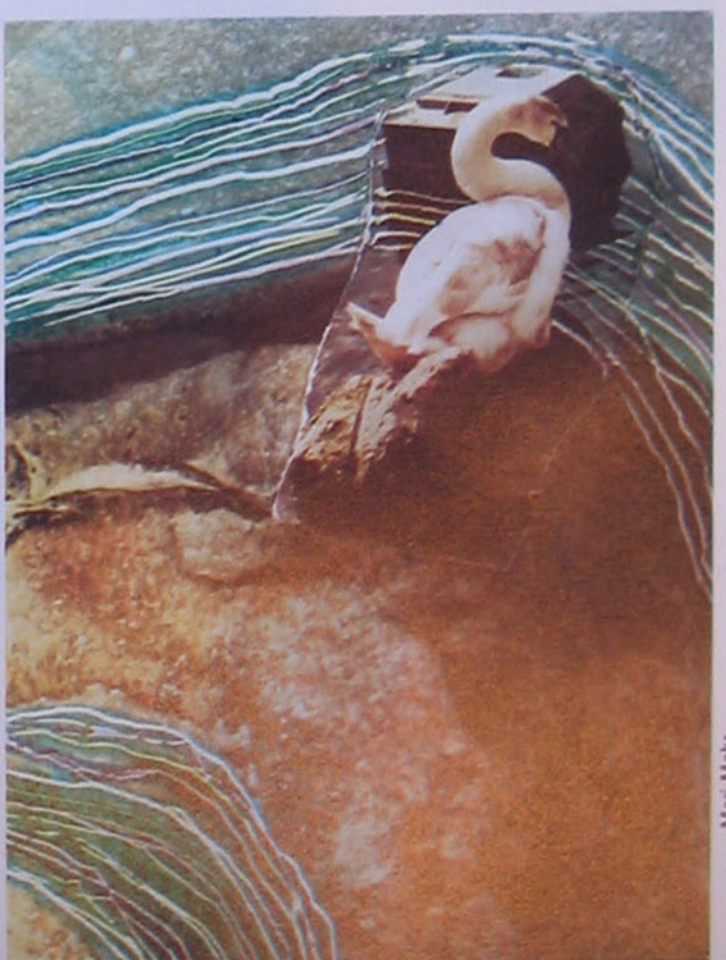
Ponderosa sing song *About a dozen different images were combined for this picture, using montage techniques. Apart from Hoss and Co (a postcard) and the flying dog, all component images were shot with the montage in mind. The montage was based around the central guitar player, and the hardest part of the process was getting the various people to the right scale and perspective. A large copy negative was made of the montage and this and the subsequent print were both retouched to conceal traces of the montage work.*

Swan on the river *A cruder but no less effective montage obtained by tearing round the image and pasting it on another, with lines scraped in the emulsion of the damp print*

Mari Mahr

Coat on a chair *Hand colouring combines very effectively with other techniques—this picture was made by combining a hand coloured print of the chair with a few quaint drawings. When hand colouring combination prints like this, try to use wax crayons as much as possible because if you make a mistake, it can often be erased by scraping gently, particularly on RC paper. Rephotograph the coloured print for a permanent record—prints treated to crayons and most types of thick paint are especially liable to damage, and must be stored somewhere perfectly dry.*

Slingshot *This intriguing picture was made by cutting around the outline of the body on a solarized image print. Backlighting and rephotographing the print gives the strange halo effect*



Mari Mahr

World of photography

The Photo-Secession

At the turn of the century, photography seemed to be the poor relation of painting, and not fully recognized as an art—but movements like the Photo-Secession and its founder Arthur Stieglitz changed all this

In the 1880s many photographers still believed that in order to be considered 'art', photography had to copy painting. In the middle decades of the 19th century, art photographers stuck to the same kind of subjects and style of approach as painting and, as a result, their photography often seemed artificial and contrived. However in the last two decades of the century a movement emerged on both sides of the Atlantic that broke away from this approach in a vital and dynamic way.

This movement was led by two major groups of photographers—the Brotherhood of the Linked Ring in Britain, and the Photo-Secession in the United States. These were particularly influential because of the efforts of two dynamic and articulate photographers—Dr Peter Henry Emerson in London and Alfred Stieglitz in New York.

Until this time 'art' photographers were restricted by the idea that they should use photography to tell a story or teach a lesson and maintain a suitably 'artistic' subject matter (see page 677). By pioneering the idea of 'naturalistic' photography—the photography of everyday subjects and scenes in an artistic way—Emerson and Stieglitz changed the attitudes radically.

The development of photography had also been held up by technical limitations but in the last three decades of the 19th century there were some revolutionary changes in photographic technique. The gelatin-bromide dry plate had liberated the photographer from the need to carry a darkroom around. Improved lenses and the introduction of roll-film led to smaller cameras, and the gradual development of much better emulsion meant that films were more sensitive to light and a wider range of tones. This, in turn, made it possible to make high quality prints, including the superb platinum prints produced at the beginning of this century.

At the same time, photography was becoming far less exclusively the activity of a group of privileged professionals and was becoming popular with a much wider public, particularly after George Eastman's introduction of the pocket-sized Kodak (see page 761) in 1888.

Photo-Secessionists *From left to right, Frank Eugene, Alfred Stieglitz, Heinrich Kuhn and Edward Steichen*

'Snapshots' began to be taken and the range of subjects that could be photographed expanded tremendously.

All these elements led to a general reconsideration of what photography was and how it could be used. Photographers who were primarily interested in art started to break away from the contrived and sentimental High Art photography. In his book *Naturalistic Photography*, published in 1889, Dr Peter H. Emerson suggested that photographers should study nature rather than paintings, and try to express their emotional reaction to what was in front of the lens. In order to do this they should abandon artificial techniques like combination printing and use instead purely photographic techniques like differential focusing and lighting.

Many art photographers began to find new inspiration in these ideas and no longer needed the traditional centres of photography, such as the Royal Photographic Society. Indeed, one group of photographers who called themselves the 'Brotherhood of the Linked Ring' positively objected to exhibiting their artistic pictures alongside scientific and 'trade' photography.

The early members of the Brotherhood of the Linked Ring included the photographers George Davison, Frank Meadow Sutcliffe, Frederick Evans and J. Craig Annan. From 1893 this group held their own photographic 'salon', where they exhibited work ranging from the 'straight' architectural photography of Frederick Evans to Frank Sutcliffe's documentation of life in the Yorkshire fishing village of Whitby.

At the same time similar breakaway groups were becoming established in the rest of Europe, notably the Photo Club of Paris. A leading member of this was the amateur painter and photographer, Robert Demachy. Like Evans and Sutcliffe, Demachy chose 'natural' subjects for his pictures but, unlike them, he still wanted them to look like paintings and used the gum bichromate process. By coating the paper with gum arabic, potassium bichromate and watercolour pigment before printing on to it, the photographer could manipulate the quality of the print. Demachy argued that a work of art could not be a copy of nature but had to be the artist's interpretation of nature—just as great artists alter the appearance of nature in their paintings, so could photographers.

At the time these movements were taking hold in Europe, London maintained its position as the world centre of

Robert Demachy/Société Francais de Photographie/fotogram

La Primavera *c.1898. A study in red by Demachy, a leading French Secessionist and founder of the Photo Club of Paris*
Bullock cart, *Burgos c.1914. This rural scene was taken by a member of the British Linked Ring, James Craig Annan*

James Craig Annan/Royal Photographic Society

photography. Some of the most original work of the late 19th century came from British photographers.

In America the naturalistic movement was slower to get under way because the strong tradition of American photography was in documentation and landscape rather than 'art'. Nevertheless, there was one American photographer, Alfred Stieglitz, who responded enthusiastically to the new movement in Europe and his influence was to be far reaching.

Stieglitz had gone to Germany in 1883 to study engineering, but as his interest in photography grew he changed to photo chemistry. By the time he had returned to New York in 1890, Stieglitz had won considerable recognition for his work—including, in 1887, his first silver medal awarded by Emerson who was then editing the British magazine *The Amateur Photographer*. He was also to be one of the first American photographers to be elected to the international Linked Ring.

Disappointed by the staid, traditional photography that he saw in America, Stieglitz set out to change American attitudes towards photography. He wanted to encourage creative photography and, after a few years running his own photo-engraving business, he campaigned through the pages of a number of eminent photographic magazines.

First he was the editor of the *American Amateur Photographer*, and then took over *Camera Notes*, the magazine of the New York Camera Club of which he was vice-president. By 1902, Stieglitz had published the work of all the photographers who were to form the nucleus of the Photo-Secession, as the movement in America became known, including the work of some outstanding young photographers like Clarence White and Gertrude Kasebier.

In the photographic world itself he was gaining considerable influence. But he and the other art photographers were aware that to gain public recognition they needed to exhibit their photographs.

In 1902, the National Arts Club of New York invited Stieglitz to organize an exhibition and this really marked the launching of the Photo-Secession. Many of the major photographers exhibited here joined together to form the Photo-Secession group. Their stated aim was to 'loosely hold together those American photographers devoted to pictorial photography in their endeavour to compel its recognition, not as the handmaiden of art, but as a distinctive medium of individual expression.' The voice of this group was a new and remarkable quarterly magazine produced under the sole editorship of Alfred Stieglitz—*Camera Work*. Over the next 14 years *Camera Work* was the forum not only of the movement's major photographers, but also of some of photography's most eloquent critics, such as Sadakichi Hartmann.

Under the direction of Stieglitz, the Photo-Secession, like the Linked Ring, was an elitist group which accepted new members only by invitation. They also refused to exhibit except as a group. Nevertheless they soon found themselves inundated by requests from galleries.

Stieglitz, although often arrogant and demanding, was a brilliant organizer and always ready to help and advise. The standard of photographs taken by the Photo-Secessionists was consistently high and this is in no small part due to Stieglitz's exacting eye, even though he was dealing with a wide range of photographic styles.

Camera Work itself was a work of art. Designed by another outstanding photographer, Edward Steichen, it was printed on the finest paper to the highest possible standards. The gravure printed illustrations were often said to be finer than the original prints.

In 1905 Stieglitz opened a headquarters for the Photo-Secession—the Little Gallery at 291 Fifth Avenue. Here he showed and sold photographs and, increasingly, paintings and drawings of

'Blessed art thou among women'
Kasebier's study was published in the first issue of 'Camera Work' in 1903

Courtesy Eastman House Photographic Section

Edward Steichen/George Eastman House

such artists as Matisse, Marin, Picasso, O'Keeffe and Rodin—many of whom had their first American exhibitions at '291'.

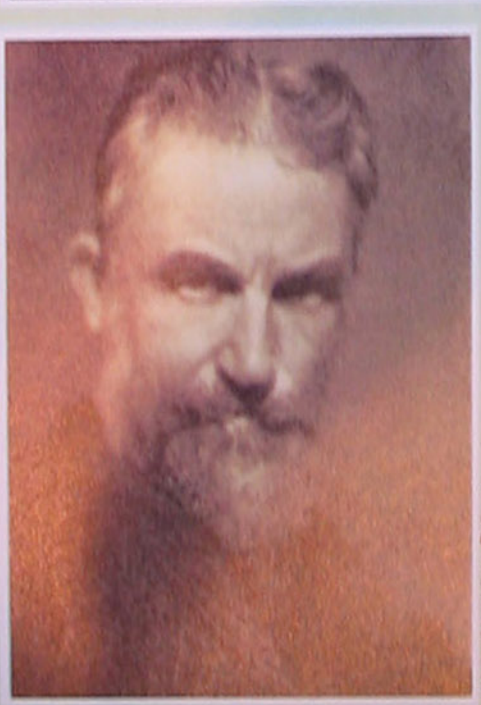
Throughout much of his career Steiglitz preferred 'straight', unmanipulated photography. When he first returned to New York he carried a hand-held plate camera and was one of the first photographers to see the artistic possibilities of photographing commonplace subjects in bad weather. This resulted in such masterpieces as *The Terminal* (1893) and *In the New York Central Yards* (1903).

However many pictorialists, like Demachy, also used a more obvious 'artistic effect'—partly to defend themselves against the criticism that photography was a mechanical medium. Frank Eugene, for example, working directly on his negatives, scratched away background detail to produce an etched effect.

A less obvious manipulation used by members of the Photo-Secession was in their printing. Stieglitz and others liked the Platinotype. This was a platinum-based printing paper with a wide tonal range, which produced a soft silvery effect on the images.

Rodin's 'The Tinker' *Steichen's study of the great sculptor was taken in 1902, the same year that he designed '291'*

Alfred Stieglitz/Royal Photographic Society



Alvin Langdon Coburn

The Steerage, *1907. One of Stieglitz's most famous pictures. He recalled, 'I saw a picture of shapes and, underlying that, the feeling I had about life'*
George Bernard Shaw *c.1906. A portrait taken for Coburn's book 'Men of Mark'*

The subjects of the new styles of photography varied from city scenes to romantic and picturesque cameos of mothers and children. Steichen was renowned for his powerful and heavily manipulated portraits and F. Holland Day for his photographs of beautiful women and exotic scenes.

In the years of the Photo-Secession the success and brilliance of Stieglitz's two ventures—'291' and *Camera Work*—shifted the centre of world photography away from London to New York. Stieglitz published and exhibited not

only American photographers but European photographers as well.

By keeping a close eye on the artistic developments in Europe, Stieglitz also helped to bring the attention of American critics to some of the newest painting styles. Gradually, painting and sculpture began to feature more in the pages of *Camera Work* and on the walls of Stieglitz's gallery. By associating photography with painting and sculpture the idea of photography as a fine art was also strengthened.

Stieglitz was introduced to much of this work by his friend and fellow-photographer, Edward Steichen, who now lived in Paris. Steichen was also a painter and knew many of the innovative young European artists.

The final and conclusive mark of the Photo-Secession's success was not made until 1910 with the triumphant retrospective exhibition at the Albright Gallery in Buffalo which broke all attendance records. The exhibition contained 500 photographs, and 15 of these were bought for the museum's permanent collection.

Photography had finally come to be accepted as a fine art which could be looked at and considered on its own terms, rather than in comparison with painting. Its aims achieved, the Photo-Secession slowly began to break up.

Camera Work, still under Stieglitz's editorship, turned itself more and more to the concerns of painting and was crititicized by photographers for its lack of photographic content. After 1911 it was circulated to a dramatically smaller circle of subscribers until in June 1917 it ceased publication. Shortly after this Stieglitz also closed '291'.

Stieglitz began to withdraw from the company of the Photo-Secessionists and in his own work, concentrated more on a new clarity and realism. In 1913, he held his first one person show for 14 years at '291', stating emphatically, 'Photographers must learn not to be ashamed to have their photographs look like photographs. A smudge of gum has less aesthetic value from an aesthetic viewpoint than an ordinary tintype (a cheap form of portrait photograph).'

The direction Stieglitz was taking was also that of modern photography. And in the last two issues of *Camera Work*, Stieglitz published the work of a strikingly original young photographer, Paul Strand. Strand's 'brutally direct' photographs were of urban scenes and ordinary objects photographed for their formal beauty and strongly influenced in their composition by the geometric abstractions of 'cubist' painting.

In complete contrast to the work of the Photo-Secession, they marked the end of an era and pointed photography well and truly into the 20th century. For his work in steering the course of this transition and for his powerful personality, Stieglitz was already a legendary figure. In later years he opened two other galleries of photography and continued to be a major figure in both the practice and theory of photography. But he is still best known as the founder of the Photo-Secession which helped to ensure lasting recognition for photography as a fine art. For, from this time on, photographs were to be judged, not in comparison to paintings but as works of art in their own right.

Harold Cazneaux/Art Gallery of New South Wales

Wharfies *c.1910. Australia's leading pictorialist used the bromoil process to produce these soft painterly images.*
Abstraction *Connecticut, 1915. Strand's bold, almost harsh, prints like this of porch shadows shattered current ideas about the nature of art photography and paved the way for a new realism*

Paul Strand/George Eastman House

What went wrong?

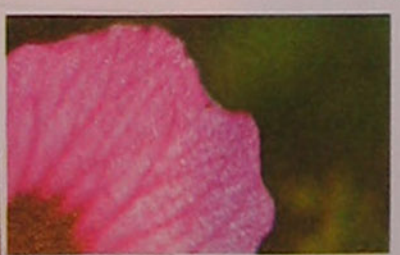
Lens problems

Lenses only rarely develop mechanical faults which spoil your pictures —mostly, picture problems which do arise are the fault of using a lens improperly

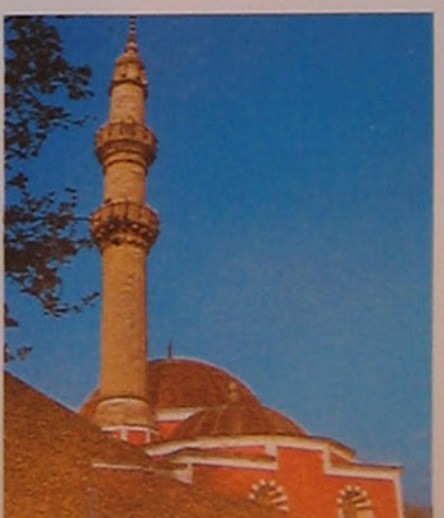
These two pictures should have been identical—they were taken moments apart on the same camera, with the same lens and exposure settings—but there is a clear difference in exposure and this suggests either a shutter or aperture diaphragm fault. Since the fault did not occur with other lenses fitted, a shutter fault can be discounted. To check the aperture operation, stop the lens down either by using the manual stop down button or by pressing the diaphragm pin link on the back of the the lens. Then turn the aperture ring through its range, checking that the diaphragm opens and closes smoothly at every stop (right)

A very common lens fault is flare, which may be caused by inadvertently including a bright highlight in the frame, but a similar effect might be due to halation on the negative (a film fault), indicated by spreading of highlights

The strange pin-pricks of light visible in the dark areas can be traced to internal reflections in the lens used to take the shot—a fault that is only significant when photographing bright lights at night



A standard lens is designed for specific conditions of use. Changing these conditions—e.g. by reversing the lens for close up work—lens aberrations may become evident. Here, colour fringing caused by chromatic aberration can be seen



This picture shows two faults : converging verticals caused by tilting the camera upwards, and curving barrel distortion. Barrel distortion is unavoidable with some wide angle lenses.

Assignment

Yosemite

Photographing the vast and varied landscape of Yosemite can be a daunting prospect—particularly if, like Sergio Dorantes, you only have a day in the park. But just a few locations can yield many beautiful landscape shots

With over 3000 square kilometres of some of the most breathtaking scenery in North America, Yosemite National Park in California has become one of the most famous photographic locations in the world. 'Eden' is a word which has often been used to describe the place and some of the greatest names in landscape photography have turned their cameras on the peaks and domes, waterfalls, forests and fauna.

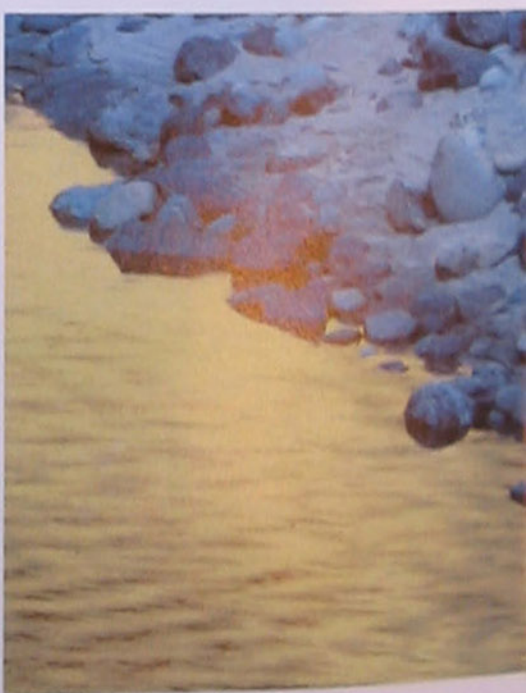
Yosemite can be overwhelming, even intimidating, at first. Asked to do what he could in a single day's assignment, Sergio Dorantes was noticeably hesitant, knowing that there were serious limits to what could be photographed there in a short space of time. To really do justice to such magnificence involves observing the changing light at different times of day and even at different times of year. As he explored the park he had little more than fleeting glimpses of the famous features—Bridalveil Fall, El Captain and Half Dome. Sergio found that the most productive part of the day was photographing a less well known area—a quiet stretch of the Merced River that he stumbled across late in the afternoon.

Sergio Dorantes

The initial excitement of finding something unexpected is a stimulating experience for the photographer. With the time being so limited Sergio decided to concentrate his effort on this tranquil section of river where the elegant shapes of the rocks were mirrored in the dark, still water. The quality of the fading light was perfect for capturing the mood of the scene.

Bridalveil Fall *In the August weather the waterfall had a relatively small flow of water but Sergio made it more prominent by using a 300 mm lens*

Fisheye landscape *The Half Dome peak is a familiar landmark in Yosemite. To produce a different view of it Sergio fitted a 16 mm full-frame fisheye*



Mirrored rock *Sergio stumbled on this scene late in the day and spent about an hour photographing the rocks reflected in the water. He fitted his 80-200 mm zoom to vary the framing from a fixed viewpoint*

Forest *One way Sergio likes to photograph trees is to concentrate on just a section of the trunks instead of trying to include everything. For this shot he used a 28-85 mm Kiron zoom that he was trying out*

Tree trunk reflections *In the same location Sergio noticed these tree trunks among the rocks. He found there was enough in this one small location to merit a whole assignment*

Golden water *The rich colour of the Merced River glistening in the late afternoon light brought to life a quite mediocre subject. The 300 mm lens picked out the graphic shapes*

Half Dome *Taken from the same viewpoint as the fisheye shot (overleaf) but with a 300 mm lens, this picture reveals the mountain in a completely different light*

Sergio Dorantes

Colour copying techniques

For the inventive photographer a colour photocopier is a useful tool. It can be used to make prints from slides, and provides a quick and easy method of making colour posterizations and photomontages

Creative photographers are always searching for new ways of manipulating their pictures to produce unusual and striking images and, perhaps surprisingly, one of the most interesting tools for this purpose is the colour photocopier. It is, of course, designed simply to produce full colour copies from a variety of originals at the touch of a button, but it can generate brilliantly coloured images from black and white originals: it can make colour copies on clear acetate film: it can produce instant prints from slides, and it can copy three-dimensional objects—even your own face.

Copy bureaux with colour photocopying facilities can be found in most major cities, but access to the machines is variable. Many of the bureaux are run by the two principal manufacturers of copying equipment, Canon and Xerox, and in these places members of the public are not normally allowed to operate the equipment. Although you can ask the staff to produce copies in a certain way, it is clearly better to experiment yourself if you want unusual creative effects. In this case, you should try to find one of the independent copy-shops using Xerox copiers where you may be allowed to operate the machines yourself. The disadvantage is that Xerox machines will only accommodate A4 size originals (210 × 297 mm) and are slightly less faithful in colour reproduction than Canon machines.

To make a straight copy on a Xerox machine, from a colour picture, place the original face down on the glass platen and press the button. The machine then makes the copy by a procedure similar to that which takes place in a conventional black and white machine. Beneath the glass platen, a tubular lamp makes three passes (instead of the usual one per copy). In the course of each pass, an image of a third of a spectrum is formed so that red, green and blue parts of the original are copied in turn. The paper copy is produced by brightly coloured toners—yellow, cyan and magenta powders—which are fused on to the paper by a heating unit. The whole process takes about 15 seconds, after which time the copy appears in a slot on top of the machine. It is not necessary to

Harry Ansen

Swashbuckling colour *It is easy to produce large areas of pure colour on a copier, either by using coloured originals, or by using the controls to generate colour from black and white*

Sergio Larrain

Daredevil biker *Although a colour copier can make rapid prints from slides, it is unlikely to ever replace the darkroom. In the Xerox print on the far right, colours are more dull and muted than in the original next to it*

know much more than this about the internal workings of the machine, since everything proceeds automatically, and most adjustments have to be made by a qualified service engineer.

However, all colour copiers incorporate external controls which can be used to manipulate the hue of the final image. Using these, and other less conventional methods, colour casts can be corrected, or deliberately introduced to the picture.

The colour balance of the copy is determined by the amounts of magenta, yellow and cyan toner deposited on the paper. The toner densities can be adjusted by three knobs on the control panel of the machine. If you have made colour prints from slides at home, correction of colour casts will present no problems. But if you are new to colour printing, deciding which knob to turn to correct a blue-green cast can be difficult. The information on pages 656 and 657 should be of some help, since the essential principles of filtration for reversal printing are essentially the same, regardless of the process in use.

The three toner control knobs can also be used to adjust the density of the copy. If it is too pale, all the toners should be increased; too dark, and they should all be reduced. It is well worth experimenting quite early on until you obtain a perfect copy, as this experience can prove valuable later—make a note on the back of each copy of the settings of the controls. You may find that copying a Kodak grey scale and colour patches helps you to set the machine up for the kind of copies you prefer.

Unusual originals may prove difficult to copy accurately. If they are very light, even setting the toner controls to full power may not provide sufficient density. If this is the case, a neutral density filter placed between the original and the glass platen usually provides a satisfactory solution. Large sheets of acrylic neutral density material are available from theatrical lighting suppliers.

Pink room *Colour photocopiers are surprisingly versatile—they lend themselves to photomontage techniques because parts of the pictures are easy to reposition, and results can be seen in seconds*

Dense originals present the opposite problem. If a satisfactory copy cannot be obtained by reducing the toner supply, the only way to make the copy lighter is to backlight the original. This can really only be done at a self-service copy bureau, and then only with the co-operation of the staff. A convenient light source is the slide projector that is often mounted on Xerox copiers for copying slides, but a more powerful lamp, such as a movie light, works better. The light should be directed so that it gives even coverage over the whole of the copy platen, and should be diffused with tracing paper or translucent plastic.

Contrast control

Contrast is always increased in copying unless special precautions are taken. The increase in contrast can sometimes add graphic impact to a picture, but more often it is a nuisance.

Some copy machines have a contrast regulation dial on the control panel, and this has the effect of adding white to the picture, making the dark areas of the picture lighter. If its limited effect is insufficient, contrast can be further reduced by using a half tone screen (see page 1128). This helps to retain highlight detail, but results in a copy that has a heavily screened appearance.

Contrast can also be successfully controlled by highlight masking. This technique is complex, but very effective. First, a contact print of the colour original is made in the darkroom at home, and exposure adjusted to give a pale grey image. This negative print is then photocopied on to clear acetate, using a conventional black and white copier. The acetate copy is sandwiched with the colour original to darken its highlights, before copying in colour.

In extreme cases, contrast can be reduced by actually whitening the original with chalk or a fine spray of white paint, though this is obviously nonreversible, and out of the question for a valuable original.

Copier operation
The controls are simple—much like a monochrome copier. A row of knobs (on the right) control the density of each of the colours, and corresponding buttons select full colour or single colour modes of operation

Prints from slides

besides copying prints and flat artwork, Xerox copiers can also make prints from slides. A special bracket on the side of the machine holds a Kodak Carousel projector which throws an image of the slide being copied through a standard filter pack, and on to a mirror which reflects it down to the glass platen. A half tone screen is used in contact with the platen to give the picture a full range of tones, and to help illuminate the slide image more evenly.

Before making a print, a white focusing sheet is placed over the half tone screen, and the size and focus of the projected image is adjusted using the projector's zoom lens. The focus paper is removed, and an initial test copy is made with all the copier controls set to 'normal' values. On the basis of the test, exposures can be adjusted using a 'lighter/darker' control on the projector, and colour

balance can be changed with the toner knobs, or by placing extra filters in front of the projector lens.

Creative techniques

Once you have mastered simple colour copying, you can begin to exploit the ability of colour copiers to manipulate images and to create colour from black and white originals. You can manipulate the copy image to produce numerous different effects and the best way to produce original images is to experiment for yourself, but there are a number of basic manipulations to begin with.

Colour from black and white By using the single colour mode of the copier, you can generate coloured images from black and white originals. The Canon copier has a range of only six colours, but on the Xerox machines, the pallet is much wider—you can 'dial in' the colour you want just by turning the toner dials. Apart from the change of mode in the copier (which is accomplished at the flip of a switch) colour from black and white copies are made in the normal way.

Copies on acetate This facility is available on both types of machine, though not as a self-serve facility. This means that the cost is higher than for self-serve paper copies. The transparencies that are produced are intended for overhead projection, but they have other possibilities for a photographer. They can be used as transparent overlays, and combined with other images to produce colour photomontage without the necessity of cutting up any of the picture elements.

Posterization The article on page 925 explains how you can make tone separations from a black and white negative. If these line images are copied on a colour machine, it is easy to build up a brilliantly coloured picture similar to those shown on these pages.

Harry Ansell

Butterfly fantasy *Iridescent colours can be generated by moving the original between passes of the copier light bar*

The final appearance of the picture depends on the order in which the tone separations are pressed against the glass platen of the copier, and further manipulation is possible by solarizing one or all of the lith positives.

Copying solid objects The copier lens has a depth of field extending about five centimetres above the platen. Thus small objects such as fruit, clothing, flowers and jewellery can all be 'copied' successfully. They can be arranged to form collages, or combined with prints to form a montage. By removing the objects between passes of the light bar, they can be made to appear in only one or two of the three primary colours.

If you can keep sufficiently still between each of the three exposures, you can even make colour copies of your face in the same way. Any movement of hair or eyelashes shows up as rainbow colours on the final copy.

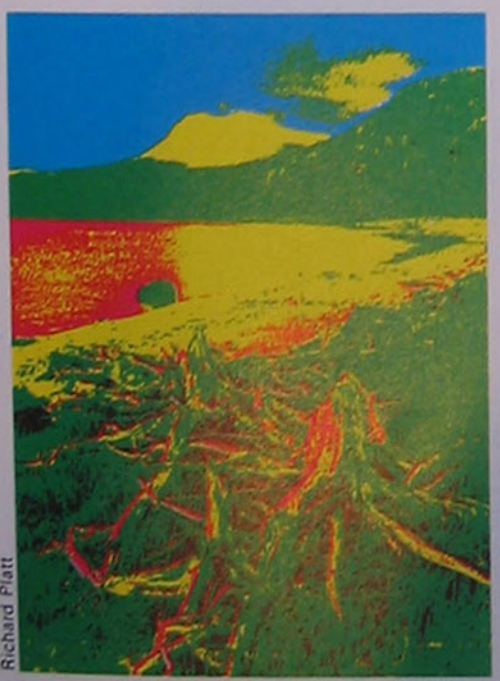
Copier limitations

Probably the biggest limitation on the use of colour copiers is the accuracy with which they reproduce the spectrum. They work best with bright primary colours, and less well with pastel shades, flesh tones and earth colours. Even these, however, copy well just after the machine has been serviced. Similar problems arise with contrast, particularly when slides are being copied. Bright highlights and deep shadow areas cannot be reproduced on the same sheet of paper. With a little practice, you can soon learn what sort of images are likely to reproduce well.

Posterization with a copier

Colour copiers build up an image by recording the three primary colours one by one. If you put a different black and white image on the platen for the duration of each pass of the light bar, you can build up a full colour image. In this case, line separations were made in the darkroom by the process described on page 925. The first was copied as pure cyan, and then quickly switched for the second, which was copied as yellow. This in turn was replaced by the third, which formed a magenta image.

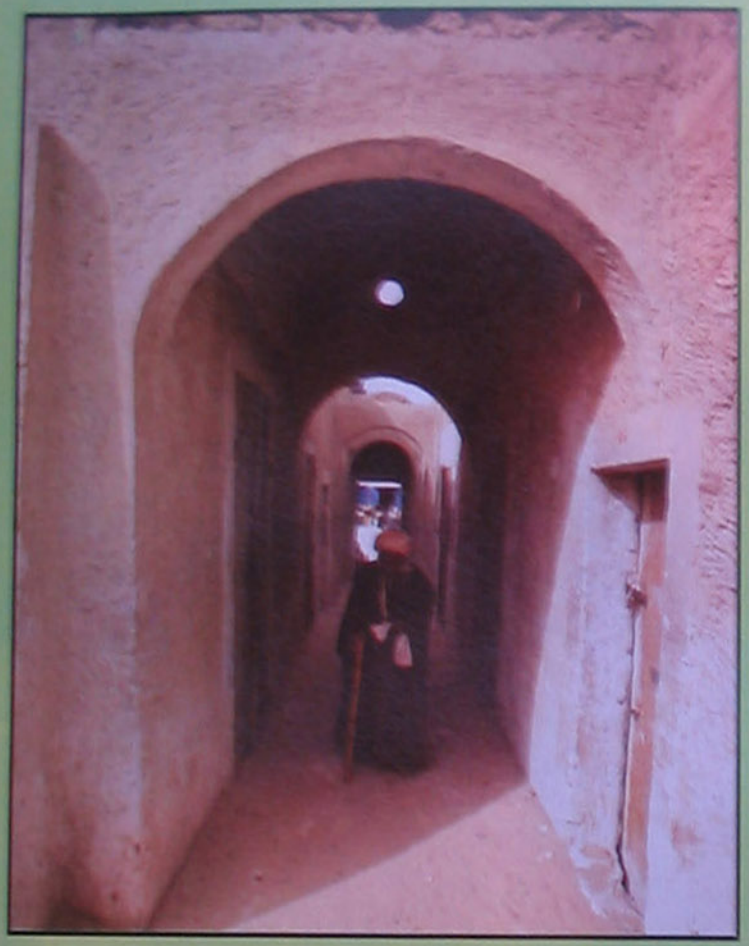
You must be nimble fingered to switch the sheets over—there is only a two second break between colours—and the dimensions of each line separation must be identical, or the coloured images will not be in exact register



Richard Platt

Characteristic curves-2

By seeing how a film's characteristic curve changes with development time, the effects of push processing—such as unwanted colour casts in the shadows—become easy to understand and predict



Timothy Beddow

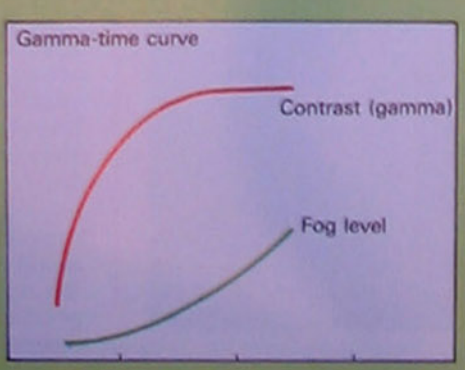
Contrast *Push processing increases contrast—which tends to result in loss of highlight and shadow detail (right)*

When photographers use a film they usually just accept the film speed written on the box. But it is useful to know how this figure is arrived at and how it can be altered. In particular it is important to know what happens when you push process a film by over-developing it.

The speed of a film depends on a number of factors. These are the exposure (the colour, duration and intensity of the light) and development (the type of developer and the amount of development). So the speed rating given to a film is only ever a guide, as the speed changes according to the way a film is used. An example is daylight balanced colour film which, when used with tungsten illumination, is 'slower'—that is, it tends to come out underexposed.

The film speeds given by the manufacturers are derived using standardized conditions with, for example, exposures of known intensities and strictly controlled development. A characteristic curve is drawn for each film and this is used to find the speed.

There are various ways of calculating film speed. The most common is to find the minimum exposure needed to produce a particular density on the negative—often a value of 0.1 above fog level. The fog level is the minimum density of the negative—no negative is completely clear—and is caused by the chemical development of unexposed grains. A developer reduces the silver halide grains to black silver and, given time, it will do this whether the grains have been exposed or not. Exposure to light simply makes the grains reduce more readily. The longer a film is in the developer the more unexposed grains are developed. Other methods involve calculations based on the steepness—or *gradient*—of particular parts of the curve. The ASA (ISO), BS and DIN systems are based on the gradient between two *speed points* on the curve which have a difference in density of 0.8, the lower being 0.1 above fog. These points determine not only the speed but also serve to standardize the development by setting a limit to the acceptable density range.



Overdevelopment *As development time increases (to the right), so the contrast goes up. But fog levels increase too, leading to dense negatives or poor density shadows in slides. This limits push processing*

Increasing speed

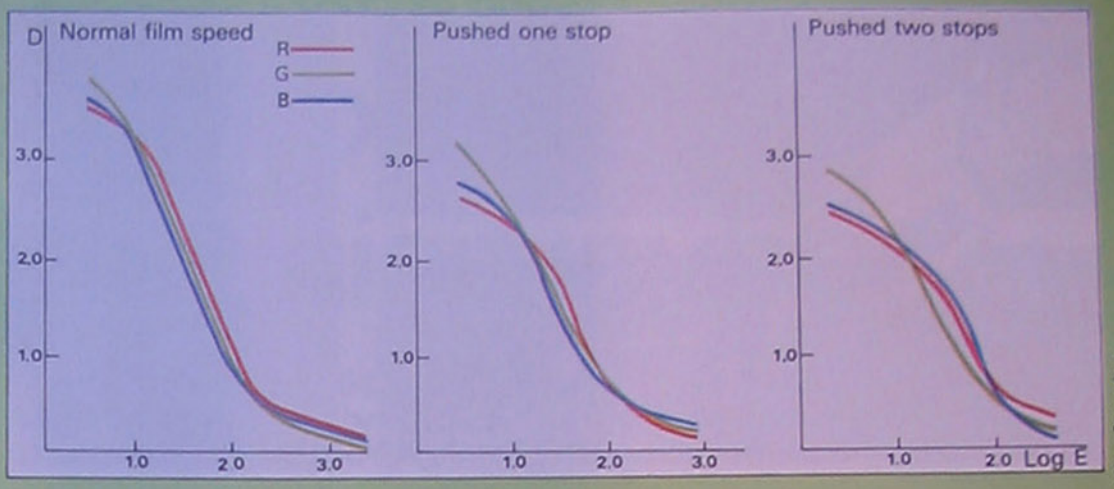
If the development of the film is changed, the curve also changes. As the development is increased—by prolonging the developing time, or increasing the temperature or agitation—the characteristic curve becomes steeper. The reason is that the density

in the highlights increases more rapidly than in the shadows. In fact the 'shadow speed' of a film cannot be uprated by more than about one stop. This is because if too little exposure is given (as happens in shadow areas) the grains do not receive enough exposure to make them developable, except for the uniform development of faster grains which causes fog, and this results in the loss of detail.

In effect the whole curve moves slightly towards the left, as less exposure is needed to give a particular density, and it is this movement which indicates an increase in speed. It is simply that the higher parts of the curve corresponding to the mid tones and highlights move more than the toe, resulting in a steeper gradient.

However, the gradient of the curve also relates to contrast. A steeper curve means higher contrast, and for this purpose the gradient is given a value known as the *gamma* (G). This relates mainly to the straight line part of the curve. Points on the toe and shoulder regions have different values for gamma, and so to simplify matters the average of the gammas is worked out to give the *average gradient* ($\bar{G}$), pronounced 'gee bar'.

So it can be seen that contrast also rises when the development of a film is increased to compensate for underexposure—or, in other words, when a film is pushed. This is further shown by an increase in the overall contrast, called the *density range*, which is the difference between the highest and lowest densities.



Mike Saunders

Colour slides *Slide film curves mirror those for negatives. The three colour layers differ when pushed—here, a two stop push gives green shadows and reddish highlights*

However, with each type of film there is a limit to how steep the gradient can get and how far left the curve can move. This means that there is a limit to how far film can be pushed. After this point has been reached extra development does not give any extra detail in the shadows because the remaining grains have not received enough exposure to make them developable in the normal way. Instead, all that happens is that the fog level continues to rise, resulting in lower contrast and insipid, empty shadows. By the time this stage is reached much detail is lost in the highlights as well, and the graininess is severe.

To get the maximum benefit out of pushing a film it is necessary to balance the increase in speed (represented by the increase in gamma) against the increase in fog. By drawing graphs of gamma against development and fog against development a point can be found giving the best increase in speed for a minimum increase in fog.

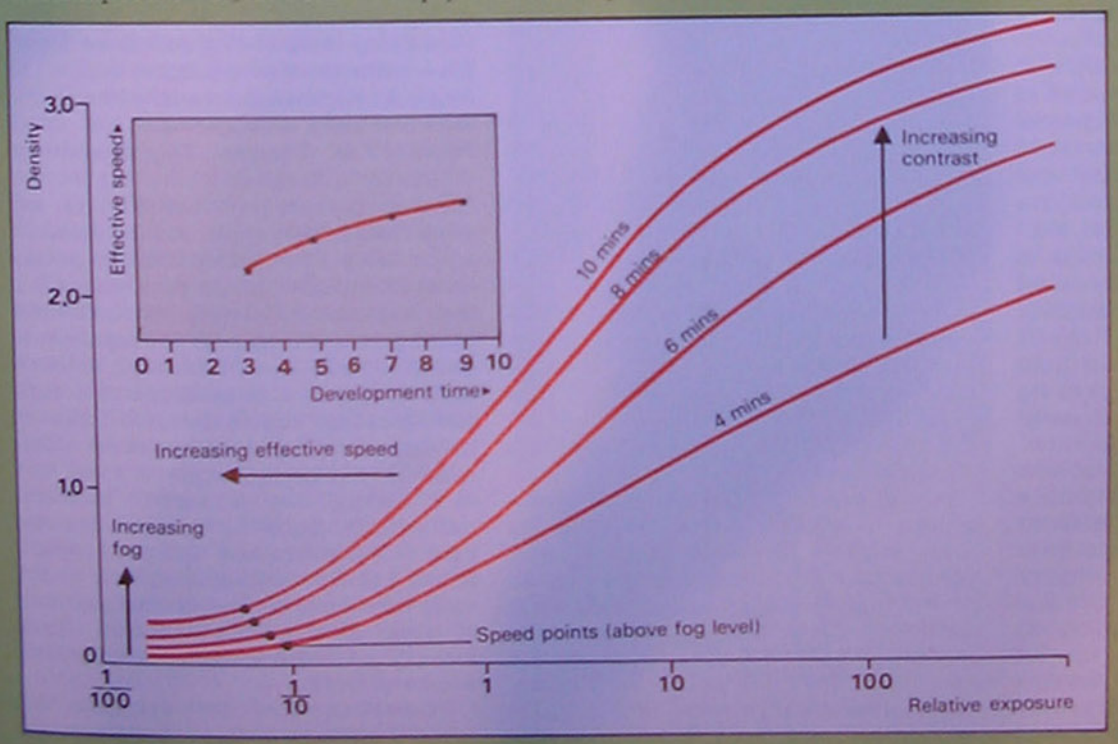
Pushing slides

Reversal materials are different in that their characteristic curves are effectively mirror images of those of negative materials. This is because as exposure increases the density decreases.

When a reversal film is pushed the extra processing is done during the first development. The increase in the fog level due to this prolonged development produces denser shadows at the negative stage. This means that after reversal the maximum density in the positive is lighter than normal. This can be quite serious as the result is a lack of strong shadows and this can make the picture look weak.

The reduction of the maximum density also means that the density range is reduced. The highlights are formed by clear film and so cannot get any lighter, so the overall effect is of a lowering of contrast.

A further problem arises with colour reversal materials. This is that the three emulsions which such films contain respond slightly differently to increased development, so that their characteristic curves no longer coincide. This is particularly pronounced in the shadow areas where, for example, the green layer may have the greatest density and the red layer the least. This separation of the curves results in a colour cast which combined with the other faults can cause a severe loss of quality, when the film is uprated by three stops or perhaps more.



Changing curves *The speed increase with developing time is measured by marking 'speed points' at a fixed density above fog. The inset shows how the increase tends to level off. Normal processing trades film speed for low fog, moderate contrast and fine grain*

Directing advertising shots

In the world of advertising over 90 per cent of the images used are produced photographically and are the result of the creative collaboration of the art director and the photographer

STAK/J. Walter Thompson/Guinness

From station walls and shop windows to newspapers and glossy magazines, advertising photographs seem to be everywhere and are now so commonplace that it is easy to pass them by with barely a thought as to how they came to be. Yet many advertising photographs are, as they are meant to be, remarkably memorable photographic images and usually their creation has demanded a considerable amount of thought. Surprisingly, though, for those who think of advertising work as one of the most glamorous and creative of all fields of professional photography, the basic ideas for nearly all these sophisticated images come not from the photographers themselves but from the art director of the agency running the campaign.

Of course, it is a photographer who actually takes the picture, but very often he or she works to such a well defined brief that virtually all there is to think about are organization and technical details—getting the exposure right and so on. Usually the photographer is provided with a drawing by the art director that shows exactly what the shot is to look like: the photographer simply turns this concept drawing into a finished photograph. Obviously there can be considerable scope for photographers to interpret their brief creatively and add their own ideas, but the general 'look' of the photograph is created by the art director.

If, for instance, a company wanted their product to appeal to young sophisticated people and needed a cool, futuristic, slightly surreal image, it is the art director for the advertising agency, who decides that the photograph will be a 'night' shot in the studio with lots of shiny metal surfaces, diffuse lighting and a deep blue background. Of course, as most art directors emphasize, creating an advertising photograph is very much a team effort and although they have a key role, many other people contribute to the final result.

In this team, there are three main groups of people. First, there is the *client* wanting to sell a product, who goes to the agency with a request for an advertising campaign to suit long term marketing plans. Second, there is the *account group* of the advertising agency who liaise with the client. And finally there is the *creative team*, who actually produce the advertisements.

Flying toucans *This photocomposition was made from about 25 original 4 × 5 transparencies. STAK photographed the bird flying in his studio, with three times his usual amount of lighting so that he could increase the speed of the flash and use a wide aperture.*
Photo: STAK; Director: Billy Mawhinney

Persuasion is the essence of any advertising campaign, and a successful advertising shot is to persuade people to buy a product or go somewhere that they might not otherwise. So whether the photograph is used in a magazine or poster or just in a handout, it must be attractive and it must attract the right people. The challenge often lies in making even the most mundane object appealing or giving a new, distinct look to a product that is neither new nor particularly distinctive. Achieving this kind of transformation and producing a strong, eyecatching photograph at the same time demands a surprising amount of work. Even a simple, almost casual looking advertising shot can demand weeks of work.

To start an advertising campaign, the account group usually discusses the

Nic Tomkins/Clarks Shoes

Hot shoe *This ad was designed by art director Jonathan Romans with photographer Nic Tompkins in mind, since they had worked together before. Tompkins' job was to turn the rough sketch (right) into an actual image—the finished version shows how well he succeeded. The images of the beam and the explosion were shot on the previous day and projected on to the set using a Brauncolor front projection machine. The text was a parody on earlier FIAT advertising which showed cars 'handmade by robots', and read, 'Piazza by Clarks. Designed by Italians, stolen by robots'*

basic nature of the campaign with the client, and the overall strategy and the way in which the product will be projected. It is clearly important to establish in just which area of the media the advertisements will appear and just how they will appear—whether in colour or black and white, in the national press as full page, or as magazine spreads, or both. It is also important to establish just who the potential customers are and decide how best to appeal to them. This might be through sentiment or humour or with a hard cutting approach—or simply through the product's 'image'. Once this has all been decided, the account group prepares a detailed dossier containing all this information for the creative team—generally the art director and a writer—who work together to produce the basic idea.

Obviously, there is considerable feedback at every stage of production but, once they have their brief, it is up to the creative group to develop the advertisement from the basic idea through various 'roughs' to the final photosession. The 'look' of the advertisement is decided at a fairly early stage and then it is a matter of trying to work out just how to achieve this look. Occasionally, a particular look may be developed a long way before it is abandoned, but this is rare because at each stage in development, it costs progressively more to make any major alterations.

Although it is not inevitable, the pictorial content of the advertisement is almost invariably photographic nowadays. Artworks—paintings and line drawings—could be used but photographs are generally preferred for a number of reasons.

Cubism *Art director Doug Buntrock gave the photographer a rough layout. A model maker then made a cardboard mock-up and a series of dummies before making the final model in Perspex. It was shot in the studio against a graduated background by John Turner. Model maker: Guy Hodgkinson*

John Turner/Leo Burnett/Perrier

Often, the art director has a particular photographer in mind when he develops the idea for the photograph. Many advertising photographers have very distinctive styles or are particularly good at one type of shot and in working out the idea, the art director may be visualizing a picture in the photographer's style. If, for instance, a glamorous, surreal image is required, an art director may decide to use Michel Tcherevkoff (see page 1352) at an early stage, and the remaining stages of development consist of creating a picture in Tcherevkoff's style. For another campaign, on the other hand, the art director may remember John Claridge's series of pictures advertising the Range Rover and may want to achieve a similar 'feel'.

Naturally, then, art directors tend to favour photographers whose work they know well, not only because they want a particular style but also because with such large sums of money at stake they must be sure that they are going to get good results. Some art directors also believe that it is essential that they get on well personally with the photographer. So, many senior art directors have a core of about ten photographers that they work with regularly and it can sometimes seem to a young photographer trying to break into advertising work that there is a closed shop. Nevertheless, up and coming photographers do get a chance sometimes when the art director wants a new approach or when the first choice is over booked.

Surprisingly, perhaps, a great deal of the organization for the photo session is left to the photographer and once commissioned, and given the art director's visualization for the pictures, it is usually the photographer's job to ensure

that all the right people—stylists, designers, hairdressers, models, etc.—and equipment arrive for the session on time for the shot.

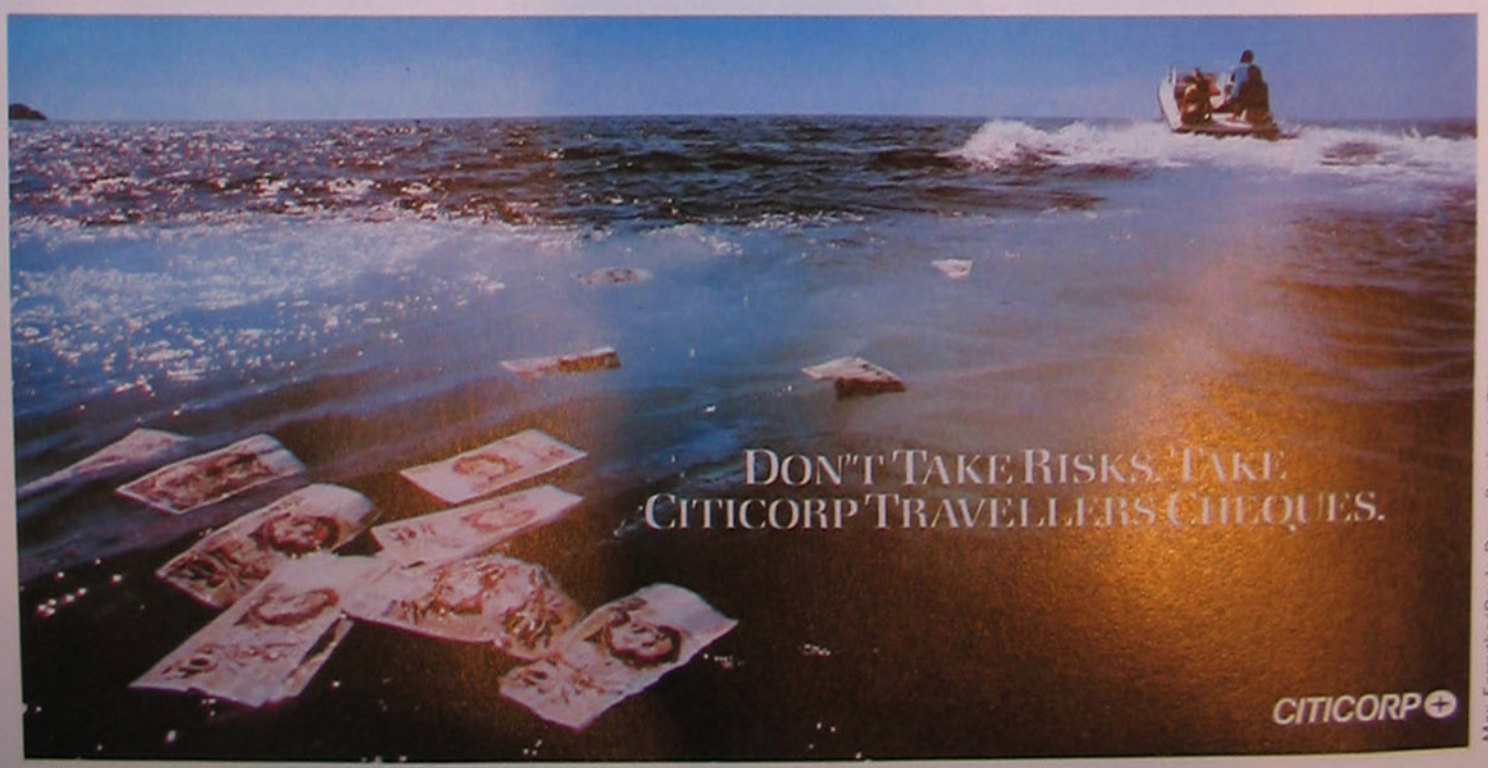
Many advertising shots are now done in the studio rather than on location. Budgets nowadays are much tighter than they used to be, and shipping people and equipment out to exotic locations can be prohibitively expensive. And if anything goes wrong on a location session, it usually costs much more to put right—location sessions tend to be much less predictable anyway, what with erratic weather, changing lighting and all the unforseen problems that can crop up. Nevertheless, many shots cannot be done in the studio, or by using stock shots, and it is up to the photographer to find a suitable location.

The photographer must also choose models needed for the session, though the art director specifies the type of person he wants. Normally the photographer suggests several possibilities to the director who can then make a decision on the basis of the model's *Z card*. Z cards are photo cards of the

Duffy/Young & Rubicam/Smirnoff

Surprise vist *To find the right location for this shot, photographer Duffy and art director Tony Whetton had to travel to Los Angeles where the model of the submarine was also built. The submarine was a copy of a U-boat which disappeared in the Atlantic during World War I. Casting for the models was also done in Los Angeles*

Sinking funds *Max Forsythe risked imminent drowning and jellyfish stings to take this picture on a rock off the coast of Sicily. He placed the specially made money (25 × 12cm) nearby and shot with a wide angle lens to increase the feeling of space. The ad was designed by Max Henry*



Max Forsythe/Doyle Dane Bernbach/Citicorp

Schwepping is making a splash in the right place.

Gary Bryan/Saatchi Saatchi Garland & Compton/Schweppes

Splash *Gary Bryan's pictures had an unusual lighting quality which ideally suited art director James Woollett's idea. The harder shadows produced by tungsten, here, give it a clean and pristine look. Shot for a summer poster campaign*

Speeding *Tessa Traeger reproduced Interflora's winged messenger motif with lilies-of-the-valley for a campaign run by the French Agency TBWA. She was chosen for her style of photography and given complete creative freedom*

Tessa Traeger/TBWA/Interflora

Max Forsythe/Colett Dickenson Pearce/Benson & Hedges

DANGER: H. M. Gover

Meltdown *This manufacturer has had a very successful series of ads based on fairly abstract ideas. A model of the packet was shot in the studio and this image was superimposed on a picture of the building shot in San Diego. Designed by Nigel Rose and photographed by Max Forsythe*

STAK/Doyle Dane Bernbach/Pierre Clarence

Napoleonic style *Art director John Scott gave STAK a copy of the painting as his brief for this advertisement and STAK employed a stylist to make sure that the details were realistic*

model that list his or her statistics, clothes sizes and interests that may be relevant such as horse riding or skiing—it is no good trying to do an underwater session with a model who cannot swim. Not all directors insist on professional models and many prefer to use people that they know in order to get a more 'natural' look.

Other things that must be organized are clothes for the model—though on all but a fashion session the model usually brings her own—props for the shot, set building and many others.

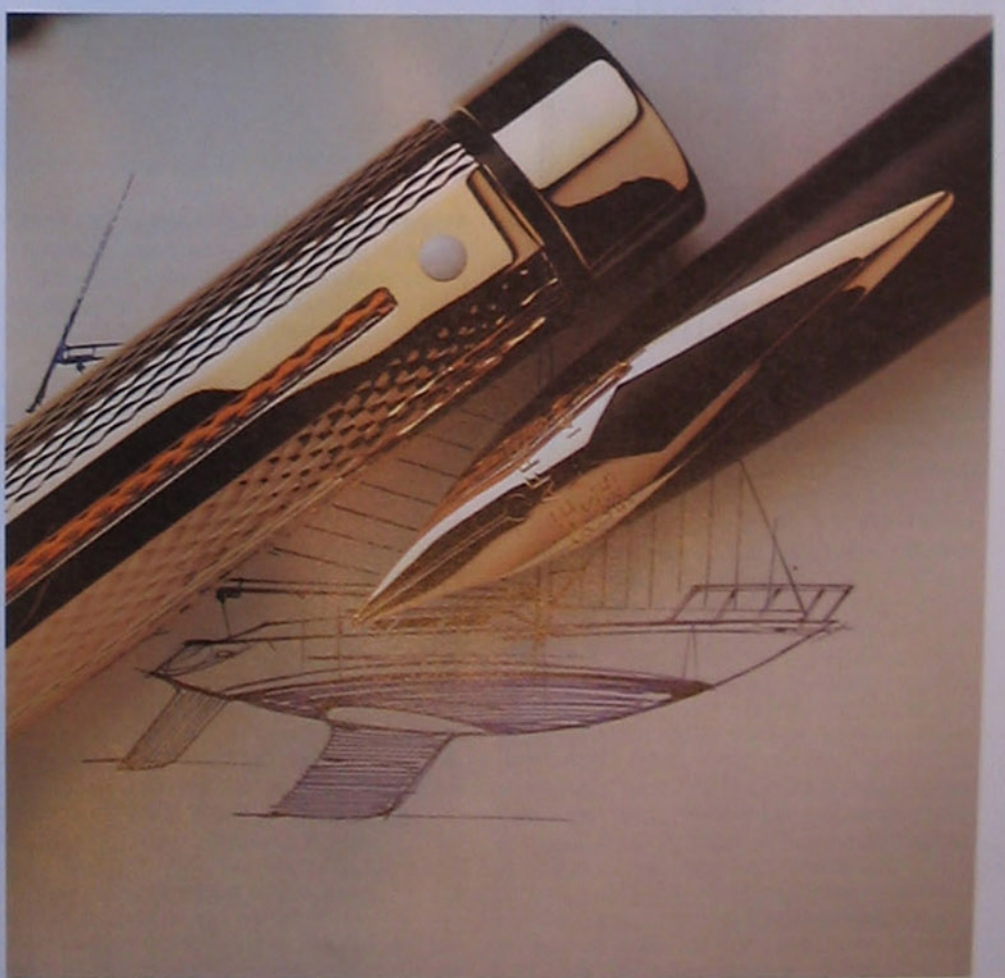
An art director will almost always attend the session because very little always works out as planned. Even if it is a simple shot of a can of beans the director needs to make sure that the end result ties in with his original idea.

On a bigger shoot the writer also attends and the client may come too. Everyone has a chance to comment. Of course there are times when the art director can slip away for a few hours, as on a big studio shot which calls for a mammoth lighting set up. He or she may appear during the early stages and re-appear when the lighting is completed. For photographs of cars, lighting is crucial and may take all day to set up. It may also take a long time to prepare the car itself—it is weighed down so it sits low on the ground and, if necessary, the tyres are sprayed a pristine black.

All types of film format are used in advertising photography and the format is chosen to suit the job. For very fine detail in a still life a 10 × 8 or 5 × 4 is best. Some art directors take a 5 × 4 transparency and have it 'duped up' (duplicated and enlarged) to 10 × 8 for better reproduction. Others insist on 10 × 8 original because this gives them a better chance to see tiny flaws which can be disguised by the retoucher. But if the design requires the photographer to capture movement, the 35 mm or 120 mm

MIDDLE TAR As defined by H. M. Government
ent Health Departments' WARNING: THINK FIRST – MOST DOCTORS DON'T SMOKE

Draughtsmanship *A picture of two large models of the Sheaffer pen shot in the studio and published with the by-line 'The best thoughts start with . . . SHEAFFER.' The shot uses visual association to suggest the pen would be used by a designer of luxury yachts. Art Director Noel Myers*



John Hammond/McCann Erickson/Sheaffer

format is usually more versatile.

Even a perfect shot may sometimes need retouching. Normally pictures are retouched just to refine colour but if a black and white photograph is to be used in newspapers it is often essential. Retouching is also used to create a vignette effect or to add extra details such as a wheel spin effect on a shot of a stationary sports car.

Photomontage is also used in different ways. It can be used to take a product out of its surroundings, enlarge it, and put it back larger than life. One particularly effective trick is to take a series of shots of a car moving at different speeds from the same angle—slow, faster and then so fast that it is just a series of streaks—and then to combine them using a portion from each transparency to show a distinct but apparently speeding vehicle. The photographer can create many special effects with his equipment but not everything. Sometimes the art director's graphic eye takes over and uses the photography as a tool to create the image he has visualized.

Using colour analyzers

Although quite expensive, an analyzer very soon pays for itself by cutting down the extravagant use of colour print paper used for conventional tests—but correct programming is essential for success

Ray Duns

Standard negative *Always select a negative that is typical of your work when you come to program an analyzer. While a photo such as this is ideal if you are to print a whole sequence of holiday pictures, it may prove to be quite unsuitable for photographs taken under different conditions, or on different film. Any areas of grey within the picture enables you to take selective spot readings*

Although colour printing can be an enjoyable experience, if you tot up the cost of the number of test prints and wasted attempts, material costs can get very high. One solution is to invest in a colour analyzer.

The purpose of a colour analyzer is to short-cut many of the test and trial stages to give the correct filter setting for each particular negative. It does this by comparing meter readings of unknown negatives with reference information obtained by making a correctly filtered and properly exposed print from a negative which is representative of your work.

The meter probe of an analyzer electronically measures the intensity of the blue, green and red components of a colour image and *integrates* or averages these to a theoretical grey. The integrated grey of an unknown negative is electrically compared with the integrated grey of the known negative, and filtration and exposure changes are made to balance the last with the first. Meter readings, using a probe, are usually taken of the colours of the whole scrambled image scattered by a diffusing device placed beneath the enlarging lens, but readings of individual areas may also be taken.

Choosing the standard negative

A vital part of the successful programming of a colour analyzer is choosing a test negative, or *standard negative*, which is typical of the negatives you are going to print in the future. In many respects, a colour analyzer is little more than an electronic reference instrument. All comparisons of 'unknown' negatives with the standard negative rely utterly on the programming data entered in its memory. Consequently, it is important not to choose a negative of a scene containing a predominant area or intensity of colour. The analyzer will simply regard this as being normal, and will bias all future readings either towards or away from this colour when images are scrambled for a reading.

It is best to choose a multicoloured subject, preferably containing an area of neutral grey (such as a pavement or roadway) and flesh tone or other readily recognizable colour. A shot taken on a lightly overcast day is ideal—shadows will be soft and relatively free of the sort of cast you can get on a bright, sunny day. Large, unbalanced areas of extremely bright or dark detail must be avoided. Overall, the best type of subject is something like a street scene containing a colourful group of objects. Choose a negative that has been properly exposed and processed on the film stock you normally use.

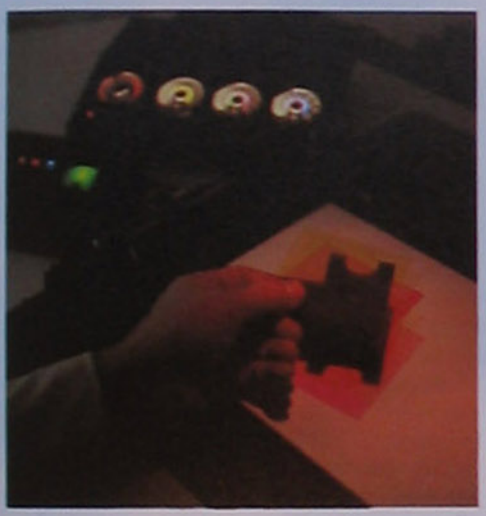
As the initial stage of programming an analyzer is making a perfect print from your standard negative, you may find it worthwhile trying out several images before making a final decision on which is most suitable for programming purposes. It really is much easier—and

Programming your analyzer

1 *Place the diffuser beneath the lens if you are taking integrated readings from your standard negative. This one clips round the lens*

2 *If you have a colour head on your enlarger, dial in the filtration which you used when making the ideal print from your standard negative*

3 *If you use individual colour printing filters, make up a filter pack such as used for your ideal print. For convenience place this on the probe itself*



4 *With the room in darkness, place the meter probe on the easel beneath the lens and locate the point of maximum brightness with the probe*

5 *With the analyser on the cyan setting, set the exposure time used for the ideal print. In turn, balance the magenta and yellow by making filtration changes*

6 *Some analyzers use a system of diodes which have to be balanced but the setting sequence is the same. Change the program for different negative types*

Ray Duns/equipment courtesy of Philips & Durst

safer—to base your assessment on a print than try to 'read' a negative through its coloured mask.

Ideal enlargement

Following your regular printing routines, produce test prints and finals from two or more of the short-listed standard negatives—in the process you should be able to establish which one would make the most satisfactory standard negative.

Before going into the final print making sequence, size up your enlargement to the size of paper you normally use for colour printing, cropping either the negative or (better still) the print area to match the formats as well as possible. Mask off the film edges and other parts of the negative which are not being printed. These areas can, of course be masked just at the easel so they do not appear in the print. However, the light extraneous to the image can severely affect analyzer readings made subsequently.

If possible, adjust the lens aperture setting to keep exposure times within the 10 to 20 second exposure range. Longer exposures start to introduce other problems, and any additional filtration of later unknown negatives compared with this standard exposure time will possibly increase the time much further.

Make as many final prints as it takes to get the most perfect reproduction of the original scene. Judge your prints in daylight or good, strong artificial light. Grey areas of the image are the best place for identifying subtle colour casts. These must be filtered out to leave neutral greys which must also be printed to their correct density. In the absence of greys in the image, look for familiar colours such as skin tones, the hues of a favourite sweater, or of everyday objects that may be in the picture.

When you have found the correct filtration and exposure time for your standard negative, make a note of all the relevant exposure information. If possible, program your analyzer right away as you can leave all your enlarger settings as they are.

Programming an analyzer

Although specific instructions are supplied by the analyzer manufacturers —these must be followed precisely— most types of analyzer are calibrated, or programmed, in a similar manner.

The diffuser attachment provided with the analyzer is attached to the lens panel in such a way that enables the diffusing element to swing under the lens for readings and out of the way for printing.

If you have removed your standard negative, replace this and restore the enlarger to the settings used for the

final print, and dial in the appropriate colour filtration (or make up the same filter pack as before). Switch on the enlarger, and switch off everything else unless you are using an analyzer of the type which fits into, or slides into, direct contact with the lens (these are unaffected by room lights).

Focus and compose the image according to your reference print, then slide the diffuser beneath the lens. Place the probe of the analyzer directly beneath the lens. Switch on the analyzer and you are ready to begin the programming sequence. Calibration of the filter dials (or standard filter density settings) of the analyzer is done in sequence, usually in the order cyan, magenta, yellow. Set each dial to a mid point position or as otherwise directed by the manufacturer.

Activate the cyan setting by pressing the appropriate button or by sliding the right filter over the probe, and 'surge' the meter by turning the exposure time dial one or two times to its maximum setting and back. Centre the meter needle approximately, and carefully move the probe around the central part of the image, under the lens, until you hit the spot which gives maximum needle deflection. If necessary, readjust the exposure dial setting to a lower setting to differentiate between points which share the same maximum deflections.

When you have found the spot which gives the biggest deflection, turn the exposure knob to the time which was required for the best print from your standard negative. Then adjust the cyan control until the needle of the meter is at the null or 'O' position on the dial.

Then, without moving the probe, press the magenta setting button and turn the magenta setting dial until the meter needle again reaches the null position. Press the yellow setting button and again zero the needle by adjusting the yellow setting dial.

The next stage is to check the settings. In turn, press the cyan, magenta and yellow setting buttons and check whether or not the meter needle maintains its zero position on each occasion. If not, carefully adjust the appropriate setting dial to apply the necessary correction, and then run a final check.

The analyzer is now programmed according to your standard negative and ideal print, and can be used to analyze any similar negative you wish to print in the future. If the working conditions are altered in any way (and this includes changing the enlarger lamp, the type of print process chemicals and paper you use, or the negative stock from which you are printing), the analyzer must be reprogrammed.

If you regularly use different types of films or processes, make an accurate note of the analyzer settings used for each as then you need not undertake the programming sequence each time you change the working conditions—simply set the appropriate 'standard' calibrations. One type of analyzer even makes use of card templates which overlay the setting dials and are individually marked for each separate program. You simply choose the correct program card and place this over the setting dials which are then adjusted according to the alignment marks you have previously made during a programming sequence. You may be able to adopt this idea for your own analyzer by using shaped pieces of card.

Programming variations

The null position on some types of analyzer is obtained by balancing a system of light emitting diodes, sometimes by making fine adjustments to the aperture of the enlarger lens rather than to exposure times as such. Apart from requiring an enlarger lens that can be released from its click-stopped settings, the operation of these follows the same basic sequence as a conventional dial meter.

The diffuser attachment used for integrated readings can be difficult to mount on some types of enlarger and so has to be hand-held during programming. This may be responsible for small fluctuations in readings when calibrations are checked for a second and third time. Normally, where variations are small, you can disregard the fluctuations. But if test prints prove that these are causing problems, you may find it better to use *spot reading* techniques instead.

Spot readings are made without the diffuser. The accuracy of the technique depends considerably on which part of the image the probe is placed, and it is essential that the right *key-tone* is selected both for programming and readings. It is best to choose a standard negative which has a large area of neutral grey (a street scene, once again, is ideal). This should give a large enough area on enlargement to take the whole area of the probe cell. For programming, simply place the probe within this area of known grey and work through the programming sequence as for integrated readings.

Integrated readings

To determine the exposure time and correct filtration for an 'unknown' negative using the integrated reading method, swing the diffuser into the light path once you have composed aud focused the image to your liking. Take care to mask off all parts of the negative which are not being printed as this edge detail may adversely influence the readings you make.

Position the probe centrally beneath the lens and press the cyan setting button. Move the probe about the central area to find the point of maximum deflection, as in programming. When this is reached, adjust the exposure time dial until the meter needle zeros, but be careful not to adjust the program knobs themselves. This is the initial time setting which invariably needs subsequent correction.

Press the magenta setting button. If the needle swings to the positive (+) side of

Subject failure

If you program your colour analyzer for one type of negative, you cannot expect it to give reliable readings when a negative of a different type is assessed — so subject failure occurs.

In the portrait shot, for example, an analyzer programmed for the harbour scene on page 1552 indicated a filtration of 90Y 90M. Not only was the resulting print too blue—because this was a thinly masked Kodacolor-II negative rather than a strongly masked Agfa one—but the red of the pullover has led to overcompensation by the analyzer, introducing a slight cyan cast as well. Correct filtration was 60Y 60M — a substantial difference.

Shots on the same roll of film may differ from the standard. The Port Grimaud 'street' was lined by predominantly yellow coloured buildings, resulting in a print which was too blue at the recommended 30M 15C filtration.

Ray Duns/analyzer courtesy of Durst

Noting programs *Blank card overlays placed on the dial panel make it especially easy to note program settings for particular film types—an idea you could adopt*

the scale, add magenta filtration using dial-in filters of a colour head, or place loose filters actually on the probe—this considerably simplifies making up a filter pack if you have to use colour printing (CP) filters. If the needle swings to the negative (—) side of the scale you have to remove magenta filtration. You may find that it is impossible to eliminate the negative deflection of the needle entirely. In this case, zero the needle by adjusting the exposure knob as for the cyan setting.

For subtractive printing you will nearly always need yellow filtration. Press the yellow setting button and add yellow filtration until the needle zeros. In the rare instances where yellow filtration has to be subtracted, set the needle to zero by adjusting the exposure needle if filtration cannot be removed. Then make filtration changes to cyan and magenta.

Even if no further changes are made to the exposure time after the cyan setting, go round the three settings again. Start with cyan and fine tune the exposure time setting so that the needle zeros. In the rare instances where cyan filtration is needed, add this to zero the needle as best as you can. Continue through the remaining settings to check correct zeroing for each colour.

In the course of adjusting filtration on a colour head you will have set the correct filtration for this unknown negative—the whole operation, checks included, should take only a minute or so. All that remains is to set the exposure time indicated by the analyzer and then you can make a colour corrected print.

If you are using separate filters in the form of a filter pack, place these in the filter drawer once filtration has been established. In using printing filters, you will probably not be able to zero the needle with quite the ease or precision you can using the variable control of a colour head. However, if the needle deflection is kept to a narrow (five unit) band over the zero position, you may not notice any adverse effect.

Spot readings

If the 'unknown' negative contains only isolated patches of colour, or large patches of one colour, *subject failure* will occur unless the normal integrated method of reading is dropped in favour of a spot reading. An integrated reading is likely to result in a colour cast because not enough—or too much—of one or more colours is considered when the probe takes its reading. What it does 'see', it tries to filter to the standard grey to which it was programmed.

Obviously it takes some experience to recognize subject failure conditions, and to start with you will just have to correct casts as they occur.

Where subject failure occurs, or is suspected, take a spot reading of a grey area of the image you recall in the subject. All sorts of problems occur if you choose anything apart from grey—the analyzer will read colour areas as grey and make the appropriate correction in error.

Go through the same reading sequence as for integrated readings, starting as usual with the cyan setting. When balancing this by adjusting the exposure time dial, use the probe to find a grey area which gives an exposure time about normal for the degree of enlargement you have chosen (or, for a same-size enlargement, the same exposure as given to the standard negative to obtain the ideal print). This routine makes it easier to get first-time results using spot readings for an analyzer which has been calibrated for integrated readings.

Better first-time accuracy is obtained by using spot readings with an analyzer which has been programmed by the spot reading method. But variations between the actual greys used for calibration (the standard negative) and readings (unknown negatives) may lead to error. You can overcome this by sacrificing a frame or two at the beginning of both films and shoot a grey card and colour swatch. The grey card area of the frames can be used for spot measurements (in the first film for programming purposes), and the colour swatch can be used as a check on colour fidelity.

Additive colour printing

The programming and reading sequence has to be adapted slightly if you are making colour prints by the additive method (pages 810 to 812). Instead of basing the cyan setting on total exposure as for subtractive printing, set the exposure time required for the red exposure in additive printing. Then adjust the cyan programming dial until the needle of the meter zeros.

Press the magenta setting button and turn the exposure dial to the time that was required for the green exposure, adjusting the programme dial to zero the meter needle. Repeat this sequence for the yellow settings to programme for the required blue exposure of your additive print. The analyzer is now programmed for additive printing.

To take a reading of an unknown negative which is to be printed using the additive method, set up the probe as already outlined. When you have found the maximum deflection on the cyan setting, zero the meter needle by adjusting the exposure dial. This gives you the exposure time required for the red exposure. Press the magenta button and adjust the exposure knob again. This gives the time required for the green exposure. Finally, press the yellow button and adjust the exposure dial to zero the needle and find the blue exposure required.

Once calibrated, your analyzer will prove to be an invaluable time-saver as it takes just seconds to read unknown negatives prior to printing.

On the road

To many motorists, roads mean long and tedious journeys, for the creative photographer they provide a never ending source of inspiration and subject matter

In the search for new subjects, the photographer may often travel great distances, looking at landscapes, buildings and people. But there is another subject, linking all the others, which can be just as fascinating, but is often ignored—the road itself.

The road has been a source of inspiration for poets, writers and painters for hundreds of years. As a subject it offers the photographer a wide variety of different themes, from the excitement of speed to the languor of a quiet country cycle ride.

With a subject as widely varied as the road, the problem is not so much one of finding something to photograph, but of deciding just what to concentrate on. Most people are very familiar with the roads and vehicles of their own environment and so general shots tend to appear rather commonplace. It can be far more rewarding with a large subject like this to select one aspect of it and concentrate on it fully.

Consider the road itself, for example. Looked at in detail, it can yield a wide variety of pictures. It can vary from a muddy track or 'green lane' to the vast expanse of a motorway. The surface texture can even be a landscape in its own right—unmade roads reveal the nature of the soil and rocks of the region, while many metalled roads use local materials for their surfaces. A wide angle lens and a viewpoint very close to the road itself can provide startling pictures.

Changes in lighting and weather conditions can have dramatic effects on the appearance of the road. Strong backlighting, for instance, shows up the grainy texture, while a covering of frost, or rain can make the normally dull,

John de Visser

Tree lined road *The photographer has deliberately made use of the lines on the road to lead the eye to the solitary car. The height of the trees is emphasized by the upright framing*

Wing mirror *Photographing the image reflected in a car mirror combines the vehicle with the surroundings. Here, the reflection of the telegraph lines add to the communicative aspect of the road*

Road hog *Motorists are not the only road users. Here the photographer has captured an amusing rural scene by looking out for the unusual. The warm light adds to the effect*

John Sims

grey surface into something far more interesting. In dark, wet conditions the road will not only glisten, but will show the reflections of differently coloured road and street lights. This is the time to brave the rain, preferably taking a tripod, so that you can make longer exposures than normal. In this way the cars that pass will show up in the pictures as blurred streaks of coloured light, giving both the impression of speed and an interesting abstract image. Even if you are not intent on photographing these movement effects the longer exposure will, in any case, allow you enough light to capture shop and street lights and their reflections in the glistening surfaces of the road.

Homer Sykes

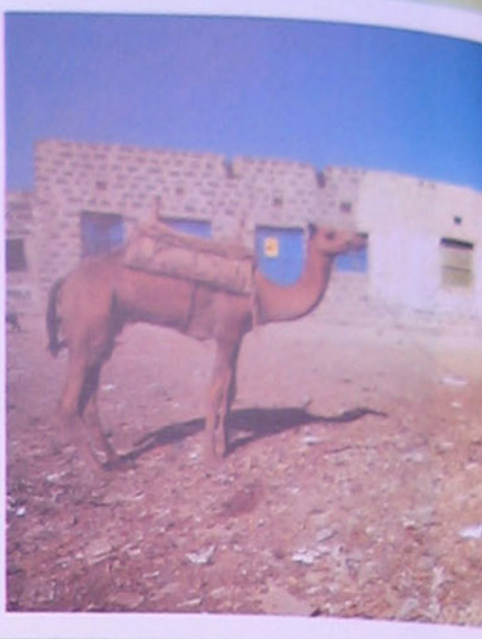
Snow is a phenomenon which can transform the road completely. A bleak, empty, snow-covered road with, perhaps, one single set of tyre tracks on it can convey a sense of loneliness and isolation very effectively, particularly if the photograph is kept very simple. When snow hides the roads completely, leaving a pure white background, any remaining details take on a special significance, and could be emphasized in your photograph. A row of telegraph poles may be the only sign that is left of the road, and a telephoto lens can be used to condense distance in this case so that it seems that the road goes on for ever. Fog and mist can be useful occasionally in pictures of the road since distracting details can be hidden in these conditions and more weight can be given to objects nearer to the camera. In this weather, headlights seem to spread into ghostly halos and foreground details appear to float. These strange effects can be used to create a weird atmosphere in a picture.

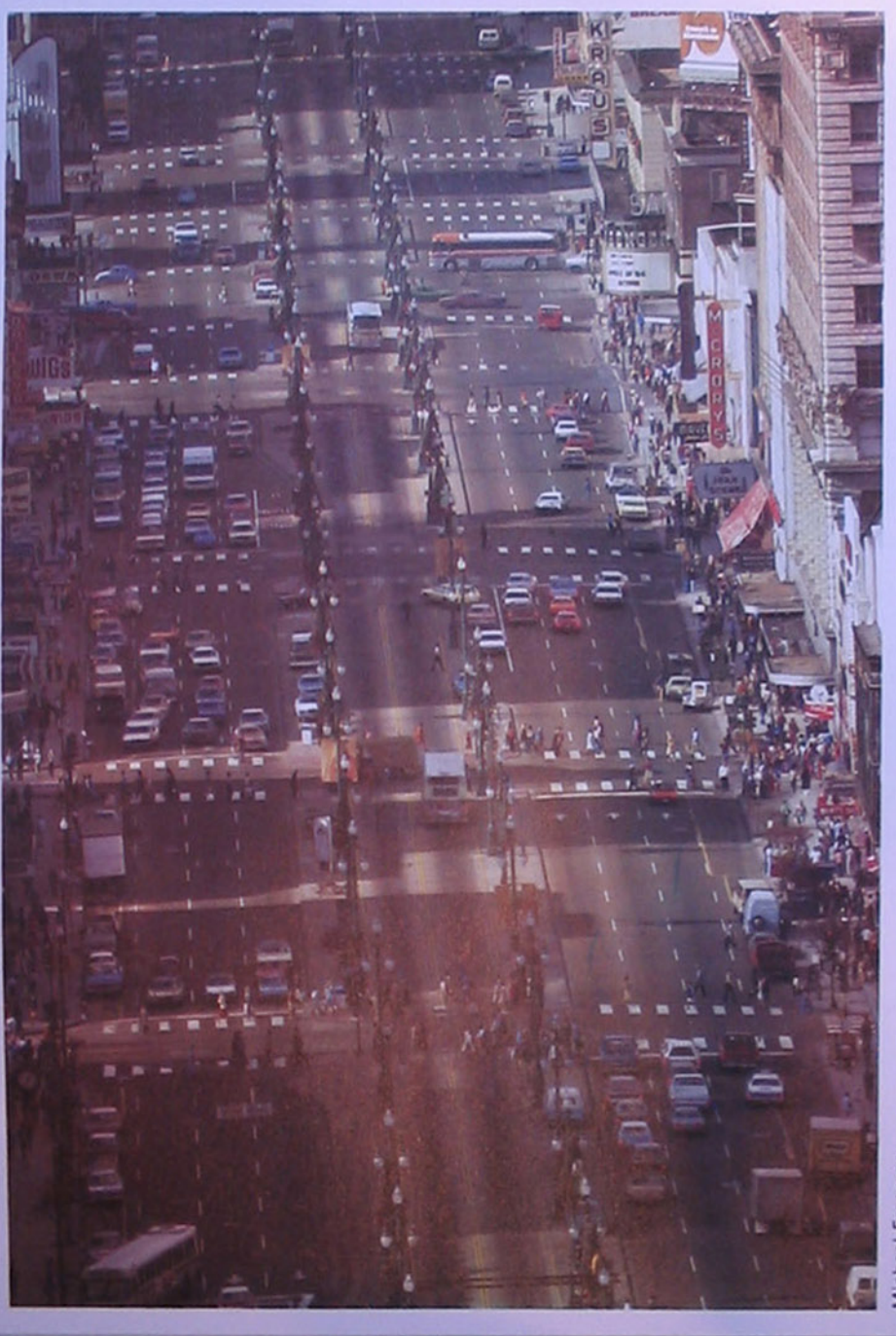
Another theme that is well worth exploring in depth, particularly if you are interested in photographing the landscape already, is that of the road in the context of the landscape. Roads can alter the landscape dramatically, and many people feel very strongly about this subject. A high viewpoint can help to reveal a road as a hard, dark slash, cutting through the soft green fields of the open countryside. In this type of picture, where you are making a visual comment on technological civilization, it can help if you choose foreground details with some care. A few wild flowers may make an added point about the vulnerability of the countryside, while a barbed wire fence may say something about the apparent ruthlessness of road developers. A telephoto lens can compress these different elements into one picture, if necessary, to make the point.

On the other hand, the older styles of road tend to follow and complement the curves and features of the countryside, and a high viewpoint, also, helps to reveal this. It may be worth spending some time to find a good or unusual viewpoint from which, perhaps, you can see the individual curves of a road as it winds along a valley. You may find a river accompanying the road, and an interesting comparison can be made between the two, so different in colour and texture. Hilly or mountainous regions are good locations for pictures of the road, particularly where the terrain is very steep. In this case you could fill the entire frame with the bends of a road as it descends steeply in a series of winding hairpin bends. A variety of different vehicles on each stretch will give the shot interest and colour. A particularly dangerous stretch of mountainous road can be emphasized by using the sad remains of a crashed car as a foreground detail, or a road sign announcing 'Dangerous Bend'.

Roads are, above all, a means of communication, and one of the ways of showing this best is probably in the midst of wild and desolate countryside. By moving back from the road and using a telephoto lens from a high position the perspective is flattened and the length of the road strongly stated. A single car, or roadside filling station or café can

George Wright

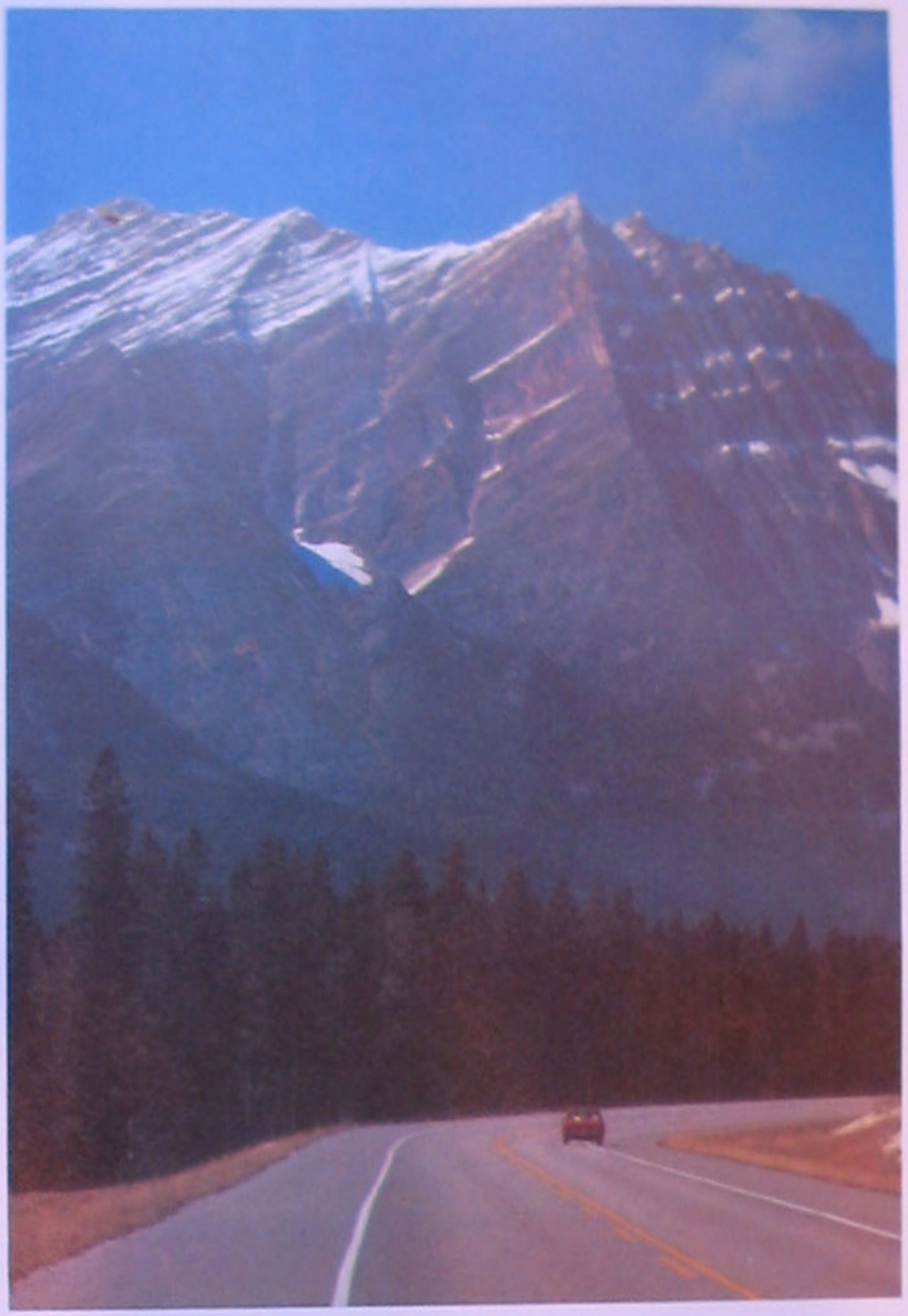




Michael Freeman

Truck stop *Roadside facilities are often likely places for creative photography, especially in the US where the freedom and romance of the road is symbolized by giant trucks that are photogenic in themselves. This scene was deliberately shot at sunrise and framed to include the reflections of the sky and a familiar roadside sign in the background.*
Camels and pickup *Juxtapositions can also make interesting shots, when transport is the theme.*
Traffic *Busy city streets are good subjects—especially shot from above*

Victor Englebert/Susan Griggs Agency



John de Visser

Mountain road *To show this road in Alberta, Canada, as part of the whole landscape, the photographer has placed it low in the frame and has included the full height of the mountainous background.* **In the dark** *The road at night is a dramatic subject—a slow exposure will record the lights of all the cars that go past, while the rest of the road remains a dark enigma.* **Road lines** *With careful and selective composition, the graphic shapes of lines painted on a road can produce striking images. Telephotos and high viewpoints are recommended*

Colin Molyneux

John de Visser

emphasize the communicative function of the road, if used as part of a wide angle composition. Standing just outside a roadside restaurant, providing that the windows are clean, you could use the window to reflect the road outside, or even to catch travellers as they arrive by car. Alternatively, you can use the road as a contrast to the warm, friendly interior where people are talking and eating, by including both scenes in one wide angle shot.

In remote regions, look for old-fashioned roadside facilities and amenities. These can make picturesque shots as well as intriguing documentary pictures. Conversely, though, motorway service stations pose more of a challenge to the creative photographer. The plain, featureless buildings that you find so often need to be set off against another element to create any visual interest. In the twilight, the light from windows and walkways, or even passing vehicles may be sufficient to do this. A careful choice of viewpoint should also allow the introduction of other subjects into the picture. A bright car passing on the road can be juxtaposed with a ponderous concrete slab above.

It is often helpful with a wide ranging subject to set yourself a project so as to direct your ideas. This could take the form of a documentation of a short stretch of road. You could try to see how varied a set of pictures you can get from the roads within five minutes' travel from your home. Or you could make a set of images to tell a story about a short journey. If you feel more ambitious you could choose an area from a map and record a wider range of roads and associated features. It is often possible to find quiet country lanes and major motorways quite close to one another and the comparison can lead to some strange but interesting images.

Traffic is, if anything, even more diverse than the roads themselves, and can provide scope for a vast range of pictures and techniques. Custom or veteran car runs give you the opportunity to see some rare and usually very photogenic vehicles. The owners are very proud of their machines and will often be most cooperative in helping to pose their cars in any way to give a good picture. The promise of a print may, in any case, secure cooperation if it is not immediately forthcoming.

Michael Freeman

Truck design *Drivers in many parts of the world go in for highly decorative painted designs. These alone make good photographic subjects*

While veteran cars may be the most striking vehicles on the road, most ordinary cars can be made to look extraordinary with a little thought. Very often just an unusual viewpoint can make all the difference. Wide angle lenses, again, can lend extraordinary shapes to mundane cars. A long vehicle can be made to appear as if it goes on for ever if you crop it so that only a section of it is seen. A small car can look minute if it is juxtaposed with a huge lorry towering over it, or if it is crammed with people. Occasionally you may catch one car as it is reflected in the window or in the shiny paintwork of another. Reflections in chrome bumpers can give strange and amusing shapes and colours to dull, mundane or otherwise commonplace cars.

The movement of both cars and other vehicles can be fascinating to capture on film, since there are many different ways of expressing the effects of speed. You can use a fast shutter speed to freeze a passing car, but it is usually far more effective to use a slower speed, blurring your subject to give a very dramatic impression of movement. Panning the camera with the car can be even more effective, since the background blurs but the subject remains sharp. This is particularly useful when you are presented with a cluttered or otherwise distracting background. A multiple image prism filter gives a series of faint images in a straight line behind the subject. Alternatively, petroleum jelly smeared on an old skylight filter can be used to streak the image and fake movement blur.

On the road there are many kinds of traffic without engines to photograph. Cycles, horses and other types of transport are still used all over the world and frequently make interesting subjects for the creative photographer. Contrasting these more primitive forms of transport with modern ones can make amusing images. A roller skater, effortlessly overtaking a city traffic jam, for instance, or Elliott Erwitt's famous picture of several men with their heads buried under the bonnet of a broken down truck, while a horse stands by. Pictures like these make their points through the obvious contrast.

Traffic jams are a part of road travel that most people are familiar with but they can provide interesting material especially when photographed from a distance with a telephoto lens. If you fill the frame entirely with the stationary vehicles, the picture appears even more crowded because of the implication that there are more cars outside the frame.

Roadside 'furniture' such as fire hydrants, road signs and traffic lights can be used to good effect in composing the picture. The colours and shapes of road signs can be useful additions to a composition, and direction arrows can add a feeling of movement, or can be used to point out specific details. With a long lens you can compress traffic signs into a jumbled forest of confusing directions, or pick out one sign and place it so that it acts as a caption within the image, sometimes with humorous results.

Isolating small details often results in strong images and the road provides endless subject matter for close-ups. An unusual road sign, the wheel spokes of an old cart, a special attachment on a sports car, even a pile of used tyres can be the basis for a fine detailed shot. With pictures like these, accurate framing and a clear, sharp rendering of the image are essential. Using a slow film and a tripod will ensure a sharp picture, and a white card may help as a reflector to fill in the shadows.

Motor bike *By including only a small area of the road the wide open space of the background has been given prominence*

David Simson

What went wrong?

Home portraits-2

Failing to think about the effects of domestic artificial lighting spoils many home portraits, but problems are easily avoided

Flash exposures in particular can be quite difficult to control indoors. For the first picture, the photographer bounced the flash off the ceiling above the sitter, but the strong shadows that resulted clearly points to the unsuitability of this technique. A much better shot is obtained by diffused frontal flash—you can achieve this using a flash reflector or umbrella

Spectacle wearers pose a special problem—how to stop reflections of flash and bright objects from spoiling the picture, clearly the fault in the left hand photograph. The simple answer is to shoot a portrait without glasses, but this is rarely satisfactory as most habitual spectacle wearers do look strange without them—or feel that way. Try changing the pose slightly as shown (far right)

Two other faults which ruin many home portraits—especially quickly taken shots—are poor choice of a background and the presence of distracting shadows caused by the close proximity of the sitter and background (far left). For less obtrusive shadows, position the sitter a little way from the background, and for formal portraits use a plain background of a colour that does not clash with the subject

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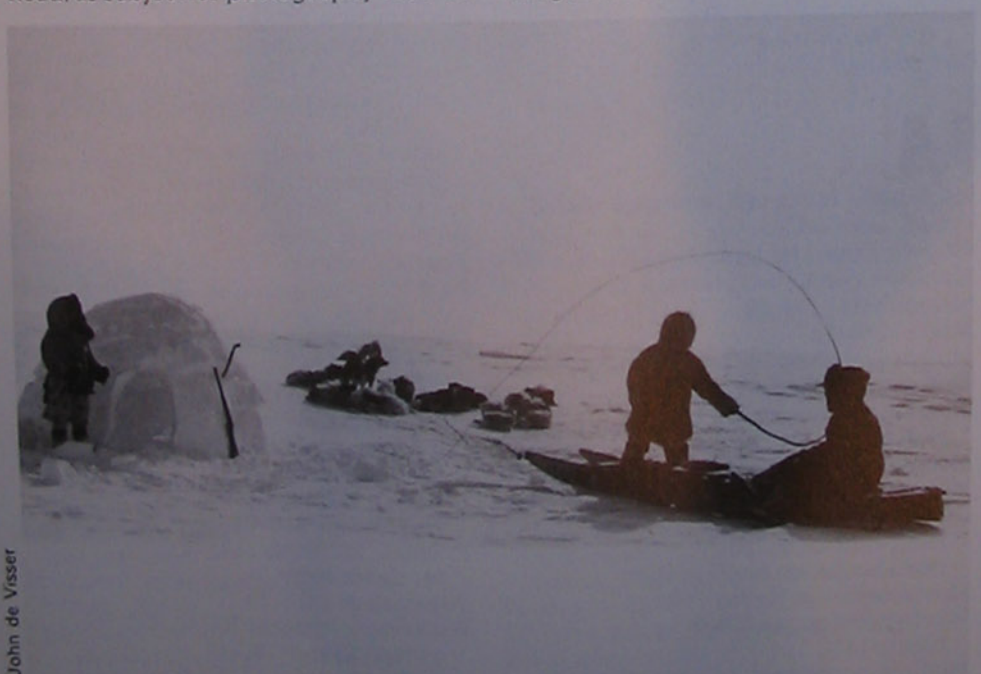

John de Visser

Snow *A hunting party's overnight igloo on Baffin Island*